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AGRICULTURAL REGIONS OF EUROPE

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EUROPE may not easily be divided into simple and general divisions, either physically or industrially. The difficulty of division is attributable to the distinctive character of the continent. It is a peninsula of exceedingly irregular and extensive coastline, projecting into that part of the Atlantic Ocean where the Gulf Drift most effectively modifies the climate to make it one of the most equable and uniform in the world, despite sharp local variations. Its mountain ranges radiate from a central region, with their greatest extent axially from east to west. It is divided into a large number of nations, each made a distinct economic unit by governmental policies of self-sufficiency, based on racial, religious, historical, or linguistic likes or dislikes.

In comparison, North America comprises only three major nations, and two languages, with such subordination of racial, and religious, and historical differences to political and economic unity that they are well nigh negligible. Its land mass is relatively compact. Its single major mountain mass, extending from north to south, is itself a natural boundary, a definite limit to a group of related characteristics—topography, temperature, precipitation, evaporation, soils, drainage, natural vegetation, crops, transportation facilities, and others. In eastern United States, the climatic and agricultural regions are belts more or less parallel in an east-west direction. West of the Great Plains the regions are more irregular both in form and trend, but even so are less difficult to differentiate than are some of the regions of Europe.[1]

The most suggestive similarity between the agriculture of Europe and the agriculture of North America is the arrangement of the grades of land utilization about the industrial centers, which are both located in the moist, temperate regions bordering upon the North Atlantic ocean; in both these regions the most intensive development of agriculture is in the hay and pasture or dairy regions in which the industrial centers are situated, and about these are arranged concentrically the successive grades of land use—grain growing, pasturing, and forestry. The Russian Steppes and the American prairies and Great Plains are strikingly similar.

The rest of the continents are more dissimilar. None of them has such large or highly developed industrial districts, none of them is so far advanced in the scientific utilization of the land, none of

[1] To divide Europe into natural regions upon any basis whatsoever is difficult, and on the basis of its plant and animal industries, particularly difficult. The complexity of physical, economic, and historical factors has led to an intricacy of relationships hard to trace, and harder still to present. In this article, the farm crop industries have been emphasized—though not to the exclusion of the forest and pasture industries—and consequently the title chosen is "Agricultural Regions of Europe."

them has such a favorable combination and arrangement of physical factors. Africa and South America are largely tropical, and southern Asia and northern Australia are likewise tropical. South America, Africa, and Australia have no such concentrations of population as do Europe and North America; and while large portions of Asia are most densely populated, with the exception of Japan their populations are apparently not so progressive as those of North America and Europe and have little surplus of raw or manufactured products with which to trade in the marts of the world. The dry desert areas of Africa, Asia, and Australia are relatively very large. Only the relatively small sections of Argentine and Chile, of South Africa, of southeast and southwest Australia, and of northern China are like North America and Europe.

LAND CLASSIFICATION

THE BASES FOR THE DIFFERENTIATION OF THE CONTINENTS INTO AGRICULTURAL REGIONS

Because land may be devoted to three principal uses—crop, pasture, and forest—the most satisfactory classification may not necessarily be based solely upon the crops, but upon the relationship between the three, and their relative importance. In the following division of Europe into agricultural regions, upon the land utilization map, and in the brief descriptions of the areas, certain terms have been employed that necessitate explanation as follows:

1a. Crop land	Crops preponderant.
1b. Crop-pasture land	Crops dominant, pasture subordinate.
1c. Crop-forest land	Crops dominant, forest subordinate.
2a. Pasture land	Pasture preponderant.
2b. Pasture-crop land	Pasture dominant, crops subordinate.
2c. Pasture-forest land	Pasture dominant, forest subordinate.
3a. Forest land	Forest preponderant.
3b. Forest-crop land	Forest dominant, crops subordinate.
3c. Forest-pasture land	Forest dominant, pasture subordinate.

In the preparation of the account the available statistics of temperature, moisture, and other physical conditions, and of agricultural and other industrial production have all been applied to the study of the natural regions of Europe as they actually exist. Most of the best atlasses and maps of the world have contributed their data, particularly those made for agricultural purposes. Those of world-wide application that have been used are:

"Geography of the World's Agriculture," V. C. Finch and O. E. Baker, Washington, 1917.
"Die Landbauzonen der aussertropischen Länder," Th. H. Engelbrecht, Berlin, 1899.
"Atlas of the World's Commerce," J. G. Bartholemew, London, 1907.
"Landwirtschaftlich statistischer Atlas," F. Lange, Berlin, 1917.
"Comparative Wall Atlas of Commercial Development," G. Philips, London.
"Physikalischer Atlas," Berghaus, Gotha, 1892.
"Atlas general," Vidal de Lablache, Paris, 1922.

Those of national or local treatment are:

"Magyarorszag gazdasagi foldrsjza," Ferenc Fodor, Budapest, 1924.
"Atlas de la Pologne," E. de Romer, Varsovie, 1922.
"Karta över Sveriges åkerareal," C. J. Anrick, Stockholm, 1921.
"Atlas över Finland," Helsingfors, 1911.
"Ekonomisk Atlas over Norge," Kristiana, 1921.
"Kartographischer Beitrage zur Wirtschaftsgeographie," G. Michel and C. Knapp, Paris, Berlin and Leipzig. Especially "Les Cereales en France," "Les fruits en Italie," and "Les grandes cultures maraicheres en Italie."
"An Agricultural Atlas of Wales," J. P. Powell, Southampton, 1921.
"Landwirtschaftlicher Atlas des Russischen Reiches in Europa und Asien," Th. H. Engelbrecht, Berlin, 1916.
"The Chambers of Commerce Atlas," Philip and Sheldrake, London, 1925.

These different grades of crop, pasture, and forest land are not based solely upon statistics showing percentages of the utilization of the land in each area, or value of production, but are determined in part by the importance and general characteristics of the use, in part by the physical conditions that pertain within the area, and in part by the reflection in the landscape of the use of the land.

Even though land may in theory be readily classified on such bases, the limits of the areas so set apart are defined only with the utmost difficulty wherever crops, pasture, and forest are of equal importance, or constitute equal elements in the landscape—as for example, in the following discussion, the coniferous forest in the small grains zone, or the mountain districts in the subtropical fruit zone, both originally forested lands. The Mediterranean mountain area or highland is now forested only in small part, and erosion consequent upon denudation has carried away the soils to such an extent, that even were it not too rough, crops could not be grown,—except locally where deposition rather than erosion is active,—and the land instead of reverting to forest becomes sparse, or inferior, pasture.

Such retrogression is general in regions of slight rainfall. The dissected uplands of Central China, unforested, unproductive, sparsely populated relatively, probably owe their barrenness to this same cause. The Canary Islands, in Alexander von Humbolt's time so beautifully wooded that he called them "The Islands of Paradise," seem to be another illustration. Some denuded regions in the United States even may furnish further illustrations of this same retrogression.

The migration of the climatic zones northward consequent upon the recession of the Pleistocene glaciation may have induced a gradual desiccation of the Mediterranean belt; on the other hand, denudation of forest, and the accentuation of both wind- and water-erosion as a result of overgrazing through centuries by the herds of goats and sheep throughout the Mediterranean lands, may merely have given a drier aspect to the landscape, and so occasioned the general historical impression of desiccation. At any rate the problem merits further discussion, and awaits solution.

LIFE ZONES AND DEATH ZONES

The use of "life" zones and "death" zones as a function of the climates of the continents seems better adapted to the consideration and description of agricultural regions than the arbitrary divisions of the earth's surface into frigid, temperate, and torrid zones. Consequently the following divisions lend themselves more readily to the purpose of this article.

A. Tropical "life" zone.
   a–b. Transition zones.
B. Tropical and subtropical "death" zones or deserts.
   b–c. Transition zones.
C. Subtropical "life" zones—the Mediterranean. (Partake of the nature of desert climate during summer and of temperate climate during winter.)
D. Temperate "life" zones.
   d–e. Transition zones.
E. Polar "death" zones.

The three zones in each hemisphere are of special significance. They lie on either side of the subtropical "death" zones and on the equatorward side of the polar "death" zones. These transition zones are due in part to low precipitation in the case of the dry desert, and to low temperatures in the case of the cold deserts. That the transition zones are the great grasslands is peculiarly significant, and arises from their distinctive climatic conditions. These grasslands include (a) the Tundra which lies alongside the cold desert and (b) the Russian steppe, the Hungarian puszta, the North American prairies (long grass) and great plains (short grass), the Argentine pampas, the South African veldt, and the Australian "bush" all of which lie alongside the dry deserts.

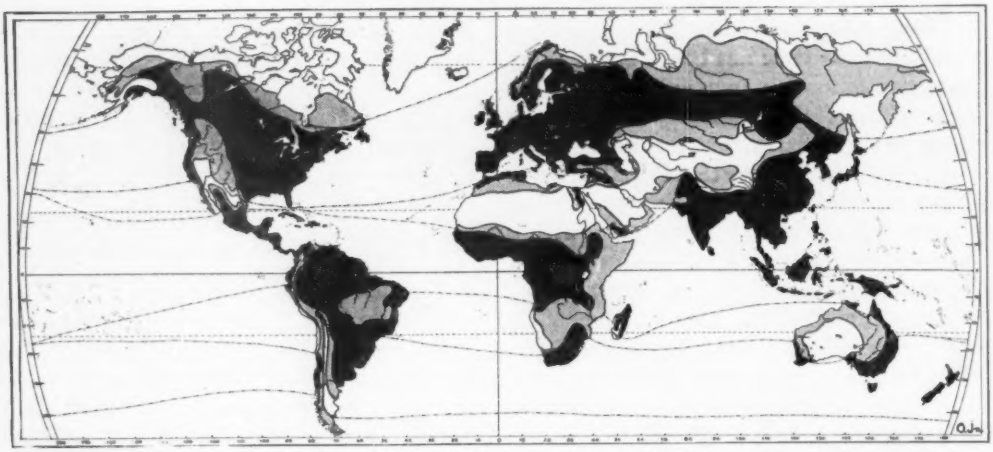

FIGURE 1.—The life zones, indicated by solid black, constitute the three great agricultural or industrial zones. They are bounded by transition zones, indicated in gray, in which agriculture is negligible and in which the vegetation gradually changes from sparse woodland and luxuriant grassland next the life zone, to sparse grassland next the death zone, indicated by white.

THE AGRICULTURAL ZONES OF THE WORLD

The "life" zones constitute the three great agricultural or industrial zones. They are bounded by transition zones in which the vegetation gradually changes from sparse woodland and luxuriant grassland next the life zones, to sparse grassland next the death zones (Fig. 1). The agricultural zones are as follows:

1. The temperate, or small grains, zone.[2]

2. The subtropical, or Mediterranean fruit, zones (Fig. 2).

3. The tropical, or equatorial products, zone.

Another major division, not a zone, which may well be considered is the monsoon, or rice, district of southeastern Asia, where distinctive physical and climatic conditions and barrier mountain ranges have given rise to a segregated, very dense population with distinctive culture. The citrus region of Florida and the coastal rice and sugar cane region of southeastern United States constitute a somewhat similar exception to the main lines of division, but in this district the monsoon conditions are not at all pronounced.

The products that distinguish these zones are not always agriculturally the most characteristic. For example, toward the cold desert margin of the small grains zones where forests almost ex-

FIGURE 2.—Picking oranges near Valencia, Spain, in the region of intensive citrus fruit culture. (Courtesy of the Keystone View Co.)

[2] In this paper, zones indicate the largest units, the subdivisions of which have been called regions (the provinces are based solely on the distribution of the small grains, and are no part of the final division into agricultural regions). The regions are subdivided into areas, but sometimes an intermediate division is made and in such cases the region is first divided into subregions which in turn are divided into areas.

clusively dominate the landscape, pasture is actually more important, measured in value of production per capita, than it is equatorward along the transition to the dry desert zone where pasture dominates the landscape. Similarly, though forests dominate the landscape toward the cold desert margin of the small grains zones, pasture is actually the dominant industrial aspect.

The desert and semi-desert zones of sparse vegetation without agriculture which separate the temperate or small grains zone and the subtropical, or Mediterranean fruit, zone, from the tropical, or equatorial products, zone, and form their poleward boundaries are divided because of their complexity, as follows:

A. Cold.
  (a) Polar or High Latitude.
    Desert.
    Semi-desert grassland or pasture.
      Supra-coniferous.
      Coniferous.
  (b) Alpine or High Altitude.
    Desert.
    Semi-desert grassland or pasture.
      Supra-coniferous.
      Coniferous.

B. Dry.
  (a) Subtropical.
    Desert.
    Semi-desert grassland or pasture.
  (b) Tropical.
    Desert.
    Semi-desert or pasture.

THE BASES FOR DIVISION

Thus the bases upon which not only Europe but all the continents may be divided into natural regions are fairly definite,[3] however indefinite the limits of the regions may be; factors extraneous to the regions must be considered, as well as those comprised within them, for the earth must be considered in its entirety if any reasonable comparison can be made of its several parts. A general view of the continents is thus obtained, as well as a general idea of the limits of the great agricultural divisions. When only minor sections of the earth are considered, these limits, even though they are essentially climatic and consequently persistent over great areas and through long periods of time, can be conceived only impartially or inadequately. The "life," "death," and "transition" zones themselves as herein considered, might not be distinguishable in the most careful study of a minor state or a single continent, even if it should be divided into definite regions,—natural, agricultural, or industrial.

One factor frequently not considered, and in many cases negligible, becomes of decisive importance in at least three major centers of human activity—northwestern Europe, northeastern United States, and east central Asia—and helps to fix the limits of certain agricultural regions about those centers. This decisive factor is the reaction of manufacturing and resultant concentration of population upon the agriculture of the contiguous regions and even upon remote lands, and includes all the changes induced in agriculture by the industrial revolution. The effect of this factor is superimposed, in this article, upon the primary division of Europe into provinces on the basis of the distribution of the small grains.

AGRICULTURAL PROVINCES OF EUROPE BASED ON THE SMALL GRAINS

From the "life" zone viewpoint, Europe is seen to consist of two life zones, two death zones, and two transition zones (Fig. 3), which considered from north to south, and subdivided into provinces (Fig. 4) are as follows:

I. Cold Desert death zone.
  1. Tundra province.

Transition zone.
  2. Polar coniferous province without agriculture.

II. Temperate, or small grains, life zone.
  3. Hay and pasture province.
  4. Polar barley province,—with coniferous forests.
  5. Oats province—with flax in Russia.
  6. Two-row barley province.
  7. Rye province—with buckwheat in Russia.
  8. Sugar-beet and winter wheat province.

[3] O. Jonasson, Näringskartorna i Svensk Skolatlas. Skriv-och Ritboksaktiebolaget, Arlöf-Gävle-Nässjö, Stockholm, 1924; or O. Jonasson, Näringsgeografisk karta över jorden, Generalstabens Lithografiska Anstalts förlag, Stockholm, 1925.

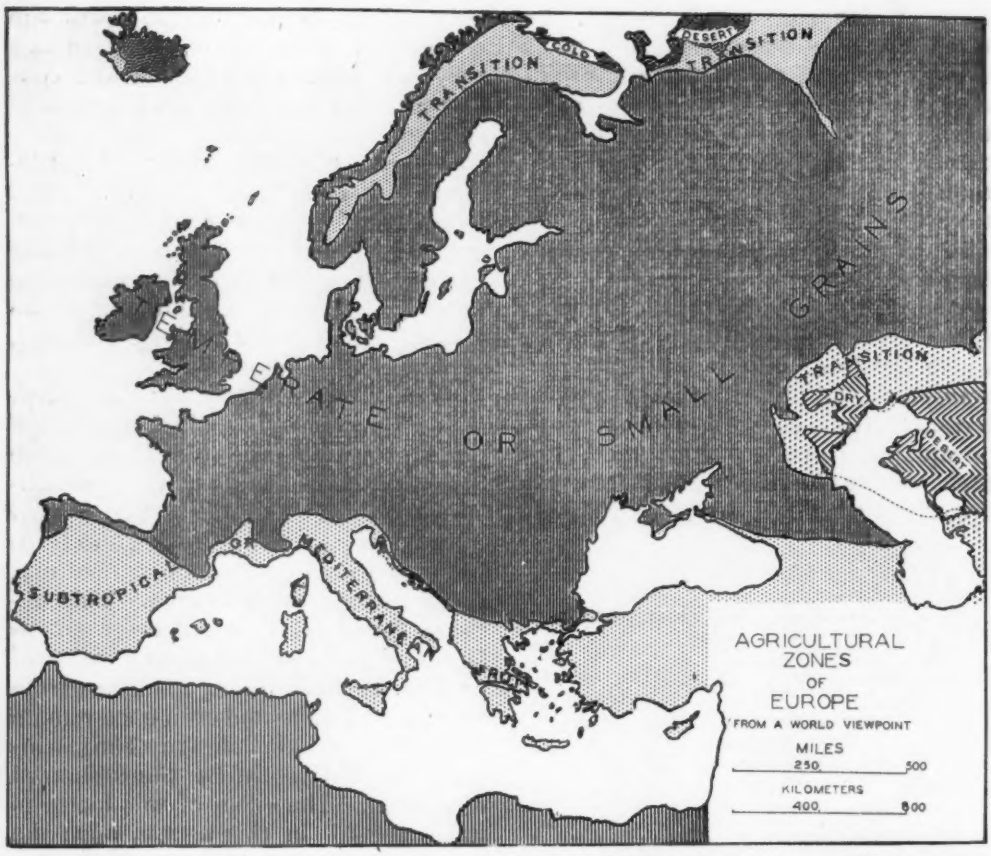

FIGURE 3.—Most of Europe lies within the temperate or small grain zone from which its concentrated industrial population derives a large part of its daily food.

9. Winter wheat province.
10. Spring wheat province.
11. Corn province.

III. Subtropical, or Mediterranean fruit, life zone.
12. Subtropical wheat province.
13. Subtropical barley province.

Transition zone.
14. Steppe province, agriculture negligible.

IV. Dry desert death zone.
15. Desert province.

EFFECTS OF THE INDUSTRIAL REVOLUTION

The primary factors controlling the distribution of the small grains in Europe are chiefly physical—temperature, moisture, topography and soils being most important—but though their influence is readily distinguishable in the limits of the present regions, these limits are quite different from what they would have been had no industrial revolution ever taken place. The industrialism founded by that revolution has modified the earlier physical limits in many places and in many ways, but most profoundly in northwest Europe, where the coal deposits primarily, and the deposits of iron ore secondarily, have given rise to the highest development of manufacturing, and so revolutionized the agriculture. Here and in east-central North America, the coal and iron deposits, the manufacturing, and the densest population coincide roughly; here are located most of the world's metal, textile, and other industries; the railway net is most closely woven; the port and terminal facilities are most modern; and all equipment for handling imports of raw products and exports of finished goods is most adequate and convenient.

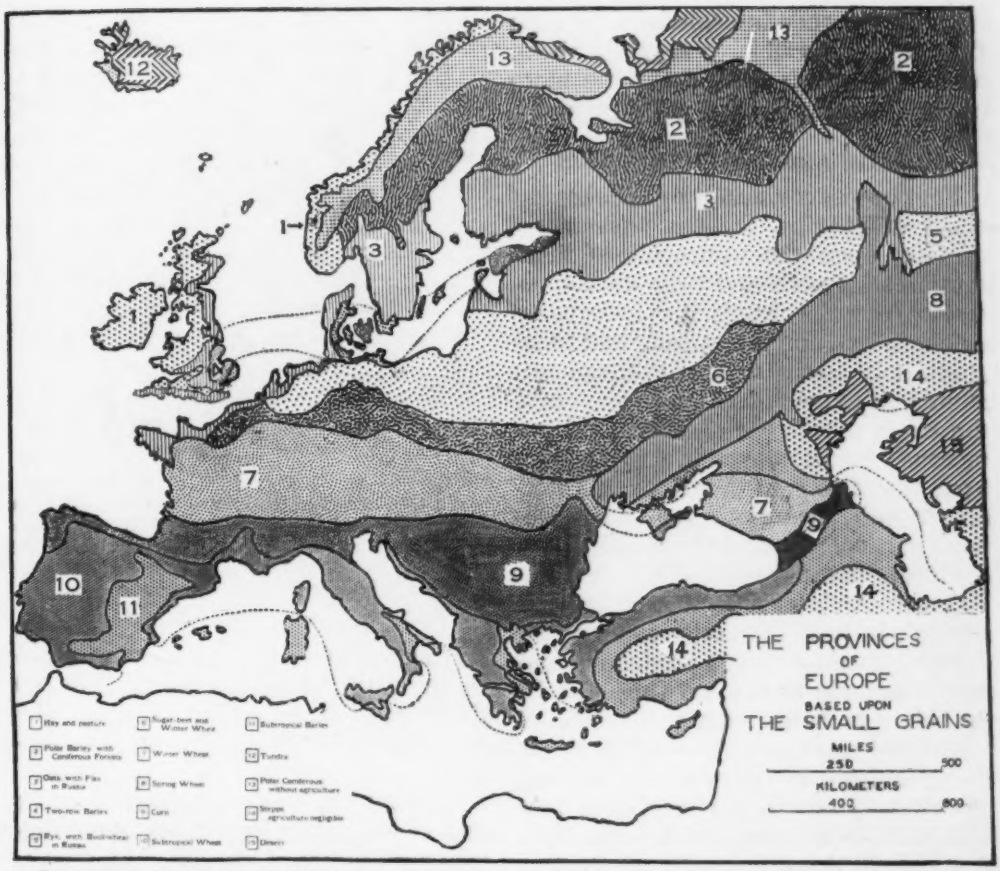

FIGURE 4.—In this generalized map the central mountain masses are ignored, and only the major distinctive characteristics of the agricultural regions considered. The boundaries of the several maps of zones, provinces, regions of land utilization, and agricultural regions are successively developed from one map to the next.

In this industrial region the production of bread cereals has been subordinated to dairy production, with which it is associated in the most intimate way. The western portion of the oats province, of the sugar-beet and winter wheat province, of the rye province, and of the two-row barley province, have developed into one general dairy, hay, root-crop region, which may be subdivided on a new basis into five subregions as follows: 1. hay, dairy, and sheep subregion; 2. two-row barley and dairy subregion; 3. sugar-beet, wheat, and dairy subregion; 4. small grains, tree-fruits, and dairy subregion; and 5. rye, potato, and dairy subregion.

Less directly, but none the less significantly, the industrialism of northwest Europe has augmented the value of production, and modified the limits, of the spring wheat region, and of the humid coastal wheat, citrus fruit, wine subregion of the Mediterranean wheat region particularly, by creating wider and better markets for their surplus products.

Historical, political, racial, and such economic factors as adequacy and availability of capital, will not be considered, though they all enter into the final result. The historical significance of rice culture in the Far East, or of corn cultivation in America; the effect of preferential duties, tariffs, and industrial taxes; the habits and customs consequent upon race or religion; the economic surplus in the accumulation of capital for development; all such factors as these are important, but intangible, and so in-

tricately are they interwoven in Europe that it is impossible to separate them, or to distinguish them from the more essential factors which will be discussed.

CLIMATE AND LAND UTILIZATION

For purpose of elucidating the simplest effect of physical factors, particularly climate, upon the utilization of land, southwest Australia, newly developed, remote from the complexities induced by industrialism, and geologically and topographically fairly uniform throughout, affords an almost ideal example. There the effect of climate can most advantageously be determined in the transition from desert to subtropical, or Mediterranean fruit, zone where moisture conditions particularly, and temperature less significantly, are graded.

Gunnar Andersson[4] in the accompanying sketch, has graphically summarized the relationship between production and precipitation in this region (Fig. 5). In the belt of heaviest rainfall, dairying and fruit- and vegetable-growing dominate the agriculture, an evidence of intensified use of the land; in the next drier belt with distinct agricultural aspect, oats, fruits, and sheep, are the distinctive products; in the next drier belt, hot and almost, but not quite, semi-desert, wheat, sheep, and cattle are raised and the landscape becomes distinctly pastoral; and finally in the belt of lowest rainfall,—less than 20 inches—and of highest temperature, the landscape approaches the true desert type, without agriculture, where only a few cattle and horses roam over extensive tracts.

Translating these idealized conditions of southwest Australia into terms of European agriculture, and interpreting them somewhat generally, we find that the belt of dairy production lies in northwest coastal Europe, the region of the most uniform and copious rainfall; inland from this coastal belt lies an irregular belt of oats, sheep, and fruit production with somewhat diminished rainfall but

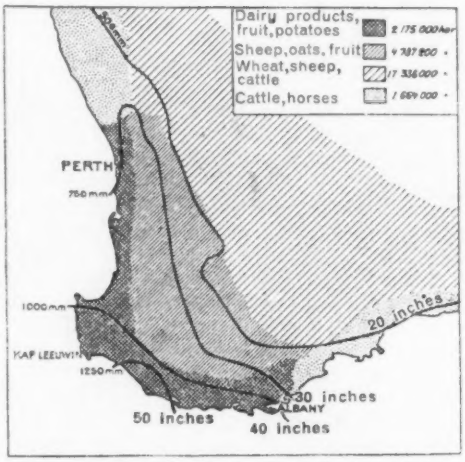

FIGURE 5.—The intimate relation between production and precipitation in southwest Australia. As precipitation increases the agriculture becomes more intensive. (From "Australien; Natur och Kultur," by Gunnar Andersson.)

still sufficient for successful crop growing; then farther inland the third belt of drier conditions where wheat, sheep, and cattle, are raised, as in some Mediterranean districts and southern Russia; and finally the peripheral belt of cattle and sheep-grazing, the highly pastoralized semi-desert of southeastern Russia.

DISTANCE AND GRADES OF LAND UTILIZATION

In a discussion of the effect of productivity upon the different grades of land it is expedient to ignore the factor of distance from, or accessibility to, market; conversely in considering the effect of accessibility to, or distance from market, it is expedient to ignore variability of production of the different grades of land. Von Thünen[5] in his admirable economic treatise on the effect on land of the distance from market assumed a soil of uniform fertility throughout a parcel of land untraversed by any route of improved transportation. An actual case of such idealized conditions is probably impossible of discovery, but the Edwards plateau in Texas, de-

[4] Gunnar Andersson, "Australien; Natur och Kultur." Stockholm, 1915.

[5] Von Thunen, "Der isolierte Staat" Zweite Auflage, Jena (Edition of 1921).

FIGURE 6.—Effect of distance from market upon the grades of land, on the Edwards plateau of Texas. In this sketch the uniform productivity of the land is assumed. (After Youngblood and Cox, Bulletin 295, Texas Agricultural Experiment Station, 1922.)

scribed by Youngblood and Cox,[6] approaches these conditions in a general way, and the diagram (Fig. 6) by which they illustrate their point differs from von Thünen's only in that their peripheral pasture lands give way to semi-desert grassland, while his grade into forest, and in that they omit his inner belt of forest. Even though von Thünen wrote (1842) prior to the extraordinary development of modern methods of transportation, his inner belt of forest seems quite incomprehensible and unwarrantable.

These studies demonstrate rather conclusively that the more productive land, the land most intensively utilized on the basis of the net value of its yield, lies nearest the city (the market), and that progressively the net value of production decreases as the distance from the market increases, until only those products that endure long distance transportation can be profitably raised, and only the most extensive use of land, large-scale ranching, is possible. From these studies it is also evident that as population increases in the more sparsely occupied regions, the ranch lands will be brought into more intensive use wherever physical conditions permit, and devoted to the growing of grains for human food; and pastoral, or range conditions, will be restricted to semi-desert and desert areas in which population will not become concentrated except locally where irrigation is practicable, or where mineral deposits permit profitable industry. It is in this tendency to more intensive use of the land that the explanation may be found for the decrease in the number of sheep over the world (Fig. 7).

Northwestern Europe, originally forested as a consequence of moister climate, offers a situation different from that of the Edwards plateau in that the outermost zone is forest instead of grassland. This difference in the peripheral belt of relative inaccessibility to market would hold in every major zone—the middle portions of the life zones, with their copious rainfall, would be heavily forested, the forests would gradually become more open toward the margins of the life zones, and the transition zones, regions of little rainfall, would everywhere be grassland. If the whole United States instead of only the Edwards Plateau section were reduced to a generalized chart, Youngblood and Cox's limiting semi-desert grasslands would hold good in the drier regions, while von Thünen's marginal forest lands would hold good where the rainfall is adequate to forest growth. The extensive pasture belt in the United States would be divided into more intensive stock-raising regions where conditions are most favorable, and ranch or range lands where the carrying capacity is low.

To illustrate graphically the effect of distance from market upon the gradation of land utilization, the accompanying sketch has been prepared (Fig. 8). An actual case with such conditions probably does not exist, though Moscow in Russia, and Indianapolis in the United States, offer inland parallels, and Buenos Aires in Argentina and its environs is a fairly

[6] Youngblood and Cox, "An Economic Study of a Typical Ranching Area on the Edwards Plateau of Texas." Bulletin No. 295, Texas Agricultural Experiment Station, 1922.

TREND IN NUMBER OF SHEEP IN IMPORTANT COUNTRIES.

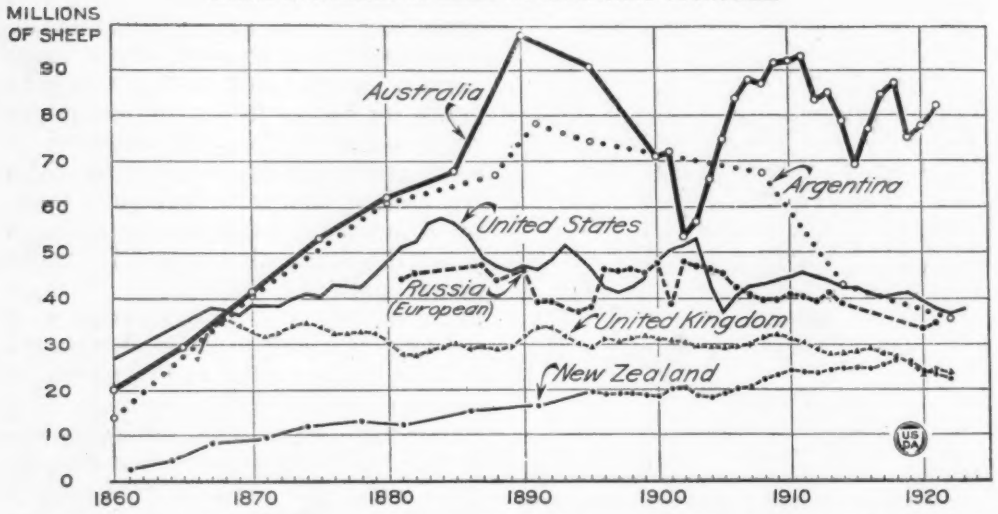

FIGURE 7.—As population increases in the more sparsely occupied regions, the ranch lands will be brought into more intensive use wherever physical conditions permit, and devoted to the growing of grains for human food; and pastoral, or range conditions, will be restricted to semi-desert and desert areas in which population will not become concentrated except locally where irrigation is practicable, or where mineral deposits permit profitable industry. It is in this tendency to more intensive use of the land that the explanation may be found for the decrease in the number of sheep over the world.

good example of such a coastal community. The essential facts, however, are that where population is concentrated, there are the best markets for imperishable as well as perishable goods; that within, and immediately adjacent to, such concentrations, floriculture, of which the product must be marketed quickly because of its perishability, is characteristic; that contiguous to the congested areas lies a belt of extremely intensive agriculture—olericulture, dairying, poultry-raising, and small fruit horticulture—of which the product is somewhat perishable, or for which the demand though urgent and continuous, is limited practically by the day's needs; that beyond this lies a belt where breadcereals, potatoes, and similar somewhat imperishable and bulky products can be most economically raised, and still bear the cost of longer transportation; and that as distance becomes greater, even these products yield to those of more extensive land utilization,—live cattle, wool, and other pastoral products, or lumber and its derivatives,—and pasture lands merge into range land or desert,

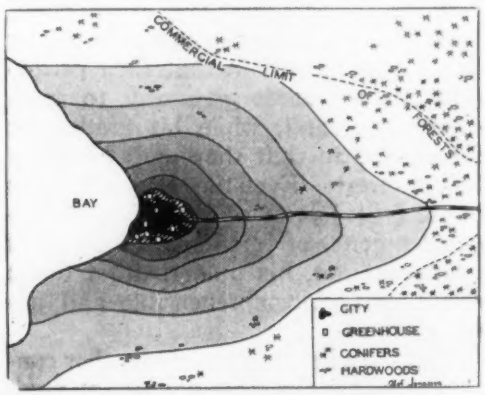

FIGURE 8.—Zones of production about theoretical, isolated city in Europe.

I. Horticulture.
  Zone 1. The city itself and immediate environs. Greenhouses, floriculture.
  Zone 2. Truck products, fruits, potatoes and tobacco (and horses).
II. Intensive agriculture with intensive dairying.
  Zone 3. Dairy products, beef cattle, sheep for mutton, veal, forage crops, oats, flax for fiber.
  Zone 4. General farming; grain, hay, livestock.
III. Extensive agriculture.
  Zone 5. Bread-cereals and flax for oil.
IV. Extensive pasture.
  Zone 6. Cattle (beef and range), horses (range), and sheep (range), salt, smoked, refrigerated and canned meats, bones, tallow and hides.
V. Forest culture.
  Zone 7. The outermost peripheral area. Forests.

or into forests. In reality, this gradation is transitional and irregular, and the belts very rarely have definite limits.

This illustration, and that of southwest Australia, serve to show the similarity of effect of physical and economic factors upon land utilization and their close interdependence; in Australia the physical factors are practically the sole control, while in Europe their effect is generally accentuated, though in some cases modified, by the economic factor.

RISE OF LAND VALUES AND INCREASING ECONOMIC PRESSURE

The classical economists, Adam Smith,[7] von Thünen, and more particularly, David Ricardo,[8] have successively pointed out that as population becomes more congested in the urban centers, and industrialism results in numerous "conurbations,"[9] of concentrated population over considerable areas, the belts of increasing intensity of land utilization widen and the relative distance of the successive belts from their central market increases; and lands previously waste become submarginal, and the submarginal lands become economically profitable; and the values and prices of all the lands increase with proximity to the center, as they do in the tracts of intrinsically more productive land, where climate, or rainfall, or drainage, or other physical factor is more favorable, and in the tracts occupied by the higher grades of farmers (Fig. 9).

Ricardo's statement "when land of the third quality is taken into cultivation, rent immediately commences on the second, and is regulated as before, by the difference in their productive powers. At the same time, the rent of the first quality will rise, for that must always be above the rent of the second, by the difference between the produce which they yield with a given quantity of capital and labor. With every step in the progress of population, which shall oblige a country to have recourse to land of a worse quality, to enable it to raise its supply of food, rent, on all the more fertile land, will rise" is amply supported, according to O. E. Baker, in the history of land utilization and land prices in the Corn Belt of the United States.

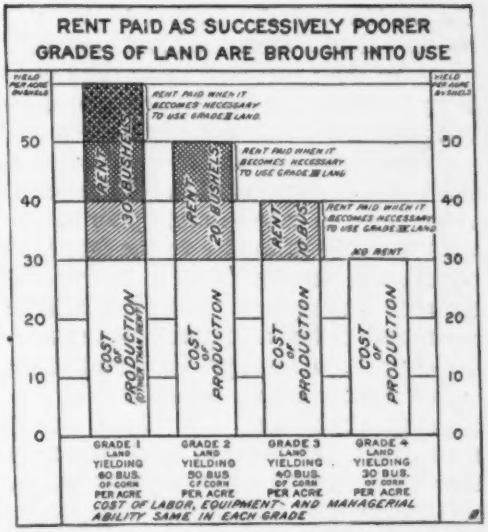
RENT PAID AS SUCCESSIVELY POORER GRADES OF LAND ARE BROUGHT INTO USE
YIELD PER ACRE IN BUSHELS
RENT PAID WHEN IT BECOMES NECESSARY TO USE GRADE II LAND
RENT PAID WHEN IT BECOMES NECESSARY TO USE GRADE III LAND
RENT PAID WHEN IT BECOMES NECESSARY TO USE GRADE IV LAND
NO RENT
RENT 30 BUSHELS
RENT 20 BUSHELS
RENT 10 BUS.
COST OF PRODUCTION (OTHER THAN RENT)
COST OF PRODUCTION
COST OF PRODUCTION
COST OF PRODUCTION
0
10
20
30
40
50
GRADE 1 LAND YIELDING 60 BUS. OF CORN PER ACRE
GRADE 2 LAND YIELDING 50 BUS. OF CORN PER ACRE
GRADE 3 LAND YIELDING 40 BUS. OF CORN PER ACRE
GRADE 4 LAND YIELDING 30 BUS. OF CORN PER ACRE
COST OF LABOR, EQUIPMENT AND MANAGERIAL ABILITY SAME IN EACH GRADE

FIGURE 9.—Illustrating the Ricardian theory of rent. No rent is paid when the value produced is only equal to the cost of production. As the economic surplus, the excess of the value produced over the cost of production, increases, the economic rent which this surplus represents, increases. The chart explains how rent increases on the higher grades of land as lower grades are brought into economic production. (Courtesy of O. E. Baker.)

Baker's[10] statement is as follows: "this explanation of rent, made over a century ago, has found ample illustration in the agricultural development of the United States. At first settlement proceeded from the less fertile lands of the Atlantic States onto the more fertile lands of the Mississippi Valley, and as a consequence land values fell in the east. But as settlement then advanced into the sub-humid areas of the western states, land values rose again. In the more fer-

[7] Adam Smith, "Wealth of Nations."

[8] David Ricardo, "Principles of Political Economy."

[9] Griffith Taylor, "The Distribution of Future White Settlement," The Geographical Review, July, 1922.

[10] O. E. Baker, "The increasing importance of the physical conditions in determining the utilization of land for agricultural and forest production in the United States." Annals of the Association of American Geographers, Vol. XI, p. 21.

tile portions of the United States this rise in value of farm land has been very rapid, in the Corn Belt more than doubling between 1900 and 1910, and doubling again between 1910 and 1920.

"This rapid rise in land values, and this increasing spread of the difference in value between excellent and poor or fair land, is owing primarily to the fact that population has increased more rapidly than the land supply. Land values have been more or less a compromise between present price of farm products and anticipated higher prices occasioned by increasing population, . . . Since about 1896, when the price of food began to trend upward with increasing population, the rise in land values has been rapid. The decade 1890–1900 is a very significant period in American history, in that it marks the turning point in the relation of land supply to population. Since then not only has the acreage of the improved land per capita of the population decreased, but also the new land brought into agricultural use is, in general, of a progressively poorer quality. It is notable how much more rapidly the excellent land of Iowa has risen in value than the poor-to-good land of New York. The low price of land in Iowa during the earlier decades, however, was largely owing to later settlement and lack of adequate transportation facilities. But the more rapid rise during the last three decades, as compared with New York has been due principally to the greater surplus productivity of Iowa land available for payment of rent."

No one has more clearly recognized or more emphatically stated the importance and the interdependence of the physical and economic factors in the use to which land is put, than has Baker,[11] not only for crop and pasture and forest, but in the further divisions of each of these into their more restricted uses. Baker recognizes four major physical factors influencing the use of land for crop production throughout the world, and six determinative economic principles. The physical factors which affect crops are:

1. Temperature conditions, particularly growing season temperatures and dates of occurrence of spring and fall frosts.
2. Moisture conditions; *i.e.*, rainfall, snowfall, hail, fog, humidity, rate of evaporation.
3. Topography, or land form; *i.e.*, the configuration of the earth's surface, degree and direction of slope, roughness or smoothness of the land.
4. Soils, including both physical structure and chemical and bacteriological characteristics.

The economic principles that explain why crops in different parts of the world occupy varying proportions of the land, are:

1. The crop or other agricultural product which is most limited in climatic or other physical requirements of production will, if the demand for it be sufficient, have first choice of the land. It possesses, so to speak, a sort of natural monopoly and consequently commands a price which gives it an advantage over other crops or products.
2. The crop or other agricultural product which has small bulk or weight per unit of value can best bear the cost of transportation and will be grown, consequently, in those regions offering the most favorable physical conditions; but not to the exclusion of more bulky crops, because a certain quantity of these bulky crops that cannot bear the cost of transportation must be grown locally to meet the local demand.
3. The varying seasonal requirements of the several crops and agricultural products for labor tend to diversify the agriculture of a region.
4. Not only is it desirable to grow such a combination of crops as equalizes the seasonal requirements of labor, but also it is important to grow such a combination of crops as will maintain soil fertility and promote freedom from insects and disease.
5. Opposed to these tendencies toward diversification is a tendency to grow the most productive crops (value per acre) on the most valuable land, and as population increases and land becomes relatively scarcer this tendency becomes stronger, since the more expensive land and more abundant labor must be profitably employed.
6. Lastly, but not least important, is the character of the farm population and the accumulated community skill and experience.

These factors and principles may all be more or less generally applied to all crops, and to forest and pasture industries.

DEVELOPMENT OF NORTHWEST EUROPE

The high cultural development of northwest Europe has resulted from the

[11] O. E. Baker, "The Potential Supply of Wheat," Economic Geography, March, 1925.

following interrelated factors or conditions:

1. Its location, not only with respect to Europe, but to the whole so called land hemisphere, particularly those lands of energetic peoples and rich resources bordering upon the North Atlantic Basin.
2. Its peninsular character, with long coastline, deep indentations, numerous islands, prominent headlands, and consequent upon these, good harbors and protected seaways.
3. Its important navigable rivers opening upon the busy North Atlantic Basin.
4. Its fairly equable, but mildly variable, stimulating climate, apparently conducive to health, vigor, and energetic effort.[12]

This district of northwest Europe, designated by Sten De Geer the main industrial region of Europe in his intensive study from a manufacturing viewpoint, may readily be distinguished from an agricultural viewpoint as the dairy, hay, and root-crop region, of which the limits are essentially the same from both viewpoints except that those of the latter are extended to include Ireland, Denmark, northeast Germany, and Normandy-Brittany, which De Geer did not include,

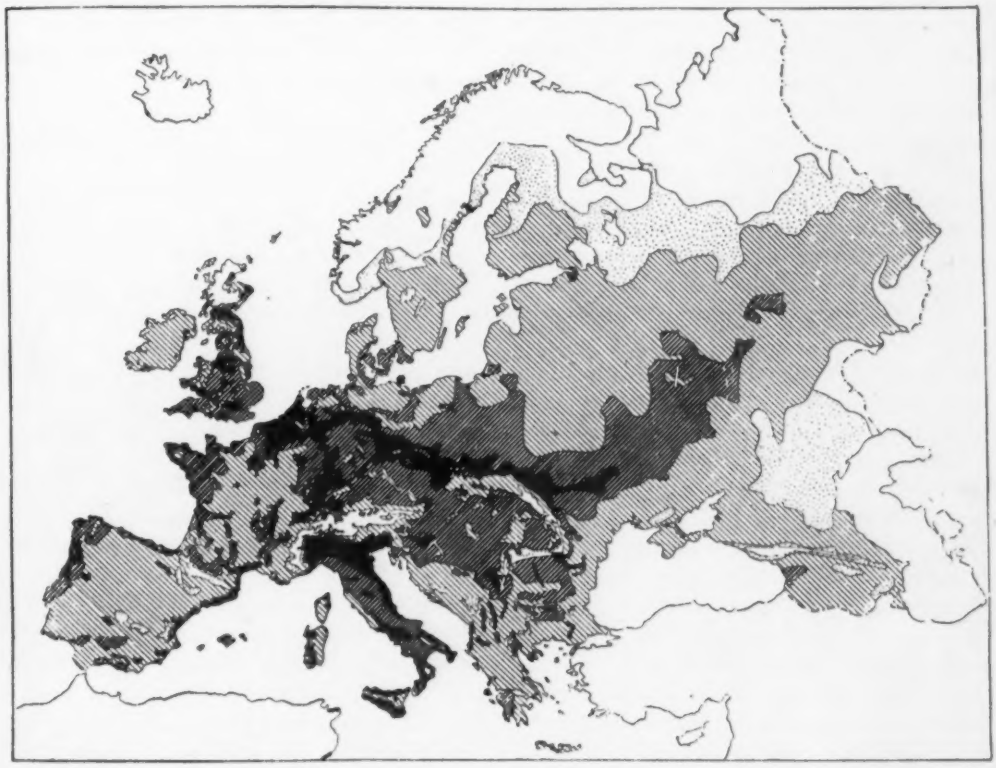

FIGURE 10.—The gradation in density of population in Europe from 500 or more to the square mile, indicated by solid black, to less than 5 to the square mile, indicated by white. (After Weise, in Peterman's Mitteilungen.)

5. Its favorable conditions for intensive agriculture among which optimum rainfall, relatively mild climate, and generally low relief are chief, promote horticulture, olericulture, and dairying.
6. Its important deposits of coal and iron localized, in large part, in this section.
7. Its rich fishing grounds on the neighboring shoals, and banks, and coasts.
8. Its racially related peoples inherently capable of intensive activity, rapid progress, and high culture.

[12] Ellsworth Huntington, "Civilization and Climate," 3rd Edition revised.

while the boundaries of the former include Upper Lombardy and the Rhone Basin which must be excluded from the agricultural, dairy, hay, and root-crops region.

The dairy, hay, and root-crops region also coincides remarkably with the region of densest population (Fig. 10). Northwest Europe may be regarded as one vast conurbation, and considered as one geographic

center of consumption and market facilities for the agricultural products of the entire inner belt of horticulture, olericulture, dairying and other intensive land uses, as illustrated for a single center in the idealized charts previously explained.

As manufacturing has developed in northwest Europe, the problem of disposing of the surplus production of the millions of workers in mines, and mills, and factories, in exchange for the food they need, for the textiles for their clothing, and other raw materials with which to keep their industries going, has monopolized the best efforts of its statesmen and business men. The solution of the problem of food supply has ever been most imperative and necessary.

As a general thing, animal products—milk, eggs, fresh meat—will not stand transportation great distances, and this fact, associated with the relatively low economic per unit cost of production of vegetable foods as compared with animal foods has led to the concentration of dairy production upon the arable lands of the industrial section. It is possible, of course, to transport by modern means of refrigeration, such animal products from even the southern hemisphere across tropical seas to the industrial centers of the northern lands, but the quantity thus obtained by the manufacturing and commercial districts has been relatively insignificant—at least until very recent times—compared with the total amount required.

Since dairying and associated types of farming are the most intensive and these types are most profitable in and about the industrial communities, it follows that the whole system of land utilization is centered upon them. In Denmark, immediately contiguous to, and even part of, the industrial region, the growing of wheat, normally the most profitable of all small grains, has given way to two-row barley and oats which here fit in more closely with the dairy type of agriculture that yields greater profit per unit area of land and per unit of human effort than crop raising. In Argentina, by way of contrast, where industry is undeveloped and land values generally low, extensive agriculture is most profitable, and wheat and corn and beef are grown, not only because climate and soil are favorable, but because the surplus can be readily transported and sold in the world's markets. Denmark's chief export is butter (on the average about $65,000,000 a year); Argentina's chief export is grain (in round numbers about $195,000,000 a year); Denmark's total area is 4,302,000 hectares, Argentina's, 298,735,000 hectares; Denmark's improved land is 2,676,000 hectares, Argentina's, 21,342,000 hectares.

LAND UTILIZATION IN CHIEF AGRICULTURAL COUNTRIES, 1923

The most highly industrialized countries have the greatest percentage of improved land, and consequently the highest grades of land utilization, as the following table demonstrates.

This table shows that the proportion of a country's land in crops corresponds roughly with its state of industry; the most highly industrialized countries approximate 40 per cent of their area in crops, significantly coincident with the proportions for those grassland countries like Hungary and Rumania, which have physical conditions favorable for crops, and which lie near the industrial centers, though not themselves industrialized. In such trans-oceanic grasslands as Argentina and Australia where, though the physical conditions are equally favorable, the proportion of land in crops is relatively low (even allowing for the extensive desert and semi-desert lands not adaptable to crops), the effect of distance from market is correspondingly distinct.

The significance of coal and iron, and their proximity to one another, in the development of the great industrial centers of the world, needs little elaboration. The Ruhr district in Germany, the English manufacturing district, grouped about the Pennines, and the American industrial section centered about Pittsburgh—all dependent upon the

Percentage in Relation to the Total Area[13]

Countries	*Crop Land*	*Permanent Grass and Pasture*	*Wood and Forest*	*Other lands*
Germany	42.6	16.9	40.5	
Austria	22.3	28.2	37.8	11.7
Belgium	39.8[1]	16.7	43.5[2]	
Bulgaria (a)	31.7	....	....	....
Denmark (b)	62.2	12.8	8.5	16.5
Spain*	31.7	50.1		19.3
Esthonia	23.4[1]	41.0	20.5[2]	15.1
Yugoslavia	25.7	16.9	30.6	26.8
Finland (d)	6.1	3.7	90.2	
France (c)	41.8	20.0	19.0	19.2
Great Britain	24.9	54.0	21.1	
Northern Ireland	37.4	50.5	12.1	
Hungary	58.9	....	....	....
Irish Free State	21.9[3]	68.1[4]	10.0	
Italy	42.9	21.9	18.0	17.2
Latvia	25.1	25.0	26.7	23.2
Luxemburg	43.6	15.4	41.0	
Norway (e)	2.2	1.0[5]	23.0[6]	73.8
Netherlands	28.2	38.2	7.3	26.3
Poland	35.7[7]	....	....	....
Rumania	36.2[1]	....	....	....
European Russia (h)	35.1	9.7	55.1	9.1
Sweden	9.3	62.1		28.6
Czechoslovakia	42.1	18.5	33.2	6.2
Canada (c)	2.5	....	....	....
United States	17.6	....	....	....
Argentina (f)	17.1	....	....	....
Chile (g)	2.5	....	6.7	90.8[8]
India* (British Provinces) (f)	45.8[9]	....	12.9	46.4[8]
India* (Indian States) (g)	58.9[9]	....	13.2	30.9[8]
Australia (g)	1.1	....	3.8	95.1[8]
New Zealand (f)	3.0	....	....	....

(a) 1921, (b) 1919, (c) 1922, (d) 1920, (e) 1917, (f) 1922–23, (g) 1921–22, (h) 1911. *The areas utilized for more than one product are counted more than once.

[1] Exclusive of bare fallows. [2] Inclusive of bare fallows. [3] Inclusive of grasses. [4] Exclusive of grasses. [5] Exclusive of pasture. [6] Inclusive of pasture. [7] Exclusive of sown grasses and bare fallows. [8] Inclusive of permanent grass and pasture. [9] The data refer only to territory dealt with in agricultural statistics.

coal and iron near, or readily accessible—illustrate this point.

The accompanying compact table reveals the trend of industrial development of the last century and a quarter:

COAL PRODUCTION IN MILLIONS OF TONS

Year	*1800*	*1850*	*1865*	*1913*	*1920*
England	10.5	50	100	292	233
Germany	....	..	28	257	243
United States	0.25	..	25	517	586
World	12.00	82.6	192	1341	1300

It began in England, and that country for the first hundred years maintained its supremacy in manufacturing, until in the beginning of the nineteenth century the United States wrested it away. The figures are not strictly comparable, for the consumption of coal in the United States to maintain transportation and the comforts of life, and per unit of manufactured product, is higher than in Germany and England; and a great deal of the coal produced in Great Britain is bunker coal for much of the shipping of the world, and export to coal-deficient nations; yet even so, the extraordinary rise in the industrial development of the United States, measured in terms of coal production, is astounding, surpassing that of Germany and England combined, and probably approaching the whole of the northwest European region,—the dairy, hay, and root-crops region,—where practically all the coal used for manufacturing is consumed.

[13] According to "Annuaire International de Statistique Agricole, 1923," p. LX.

THE TREND OF LAND UTILIZATION

The general effect of this industrialism upon the agriculture of northwest Europe, has been to decrease the proportion of

land devoted to the growth of small grains, with the exception of two-row barley, and oats, as already indicated: to increase the acreage of pasture and fallow; and to devote the land to the production of (1) forage crops for dairy use, as hay-grasses, clover, alfalfa, vetch and other legumes, and others; (2) root-crops yielding high returns upon correspondingly high expenditure of capital in equipment and fertilizer and of labor in tillage and harvest, such as potatoes, sugar-beets, turnips, stock-beets, and similar crops; and (3) truck-farm produce most intensive of all, such as beans, peas, onions, lettuce, tomatoes, and other garden vegetables. These with poultry-raising, and dairying with incidental but important swine production, characterize the dairy, hay, and root-crops region.

The American counterpart of this region is Baker's "hay and pasture region" of northeast United States where 50 per cent or more (according to statistics from small areal units) of the total improved land, plus the permanent pasture, is devoted to hay and pasture; but the proportion of hay-forage crops, and rotation and permanent pasture in America is higher than in Europe.

The peninsular character of western Europe, and the consequent relatively greater distance from the industrial region to the interior natural grasslands have favored the development of certain characteristic differences between the agriculture of the dairy, hay, and root-crops region and the agriculture of the American hay and pasture region where the natural grasslands, now occupied by the spring wheat region and the corn-belt lie relatively nearer the industrial region; for the same reasons, the transition zone between the dairy, hay, and root-crops region and the regions of dominant grain-production in Europe is wide and gradational, while in America the transition from Baker's hay and pasture region to the corn belt and spring wheat region is narrow, or in places absent, though it seems to be becoming wider and more nearly continuous.

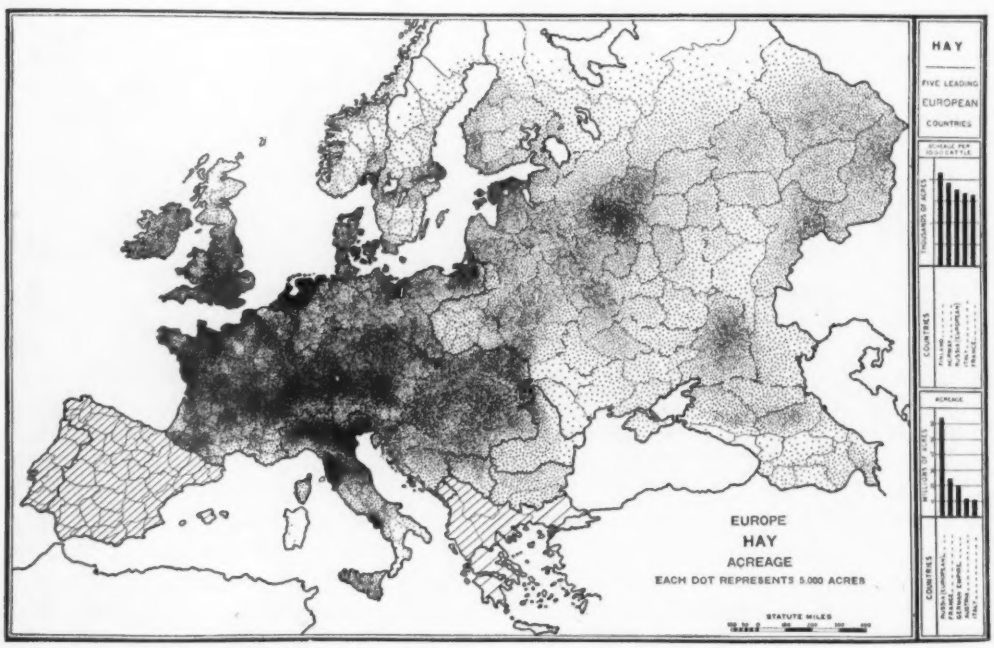

FIGURE 11.—The distribution of hay in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

If Baker's basis for his American hay and pasture region—50 per cent or more of the total improved land, devoted to hay and pasture, plus the permanent pasture—were applied to the division of Europe, the hay and pasture region of that continent would include not only the dairy, hay, and sheep subregion comprising the British Isles, northwestern France, the Netherlands, the western coast of Germany, and the southwestern part of Denmark, but also most of Norway, Sweden, Finland, Russia (except the southern part), the Baltic States, Czechoslovakia, Poland, Jugo-Slavia, Austria, Switzerland, and the Mediterranean countries. In brief, it would include the whole of Europe with the exception of such natural grassland countries as Hungary, Bulgaria, South Russia, and South Rumania on the one hand, and on the other, the highly developed manufacturing countries, Germany, France, Belgium, and Denmark, where root-crops (primarily potatoes), oats (for feed for domestic animals), and dairy products, hogs, and poultry, distinguish the use of the land. Thus hay, the distinguishing crop of Baker's American hay and pasture region, in Europe extends far beyond the limits of the dairy, hay, and root-crops region, while the distinctive crops of this European region are generally, though not dominantly, distributed over Baker's hay and pasture region (Figs. 11 and 12).

The following table indicates for several of the European countries the percentage of the cultivated land and permanent grassland devoted to fallow, forage crops, and permanent pasture.

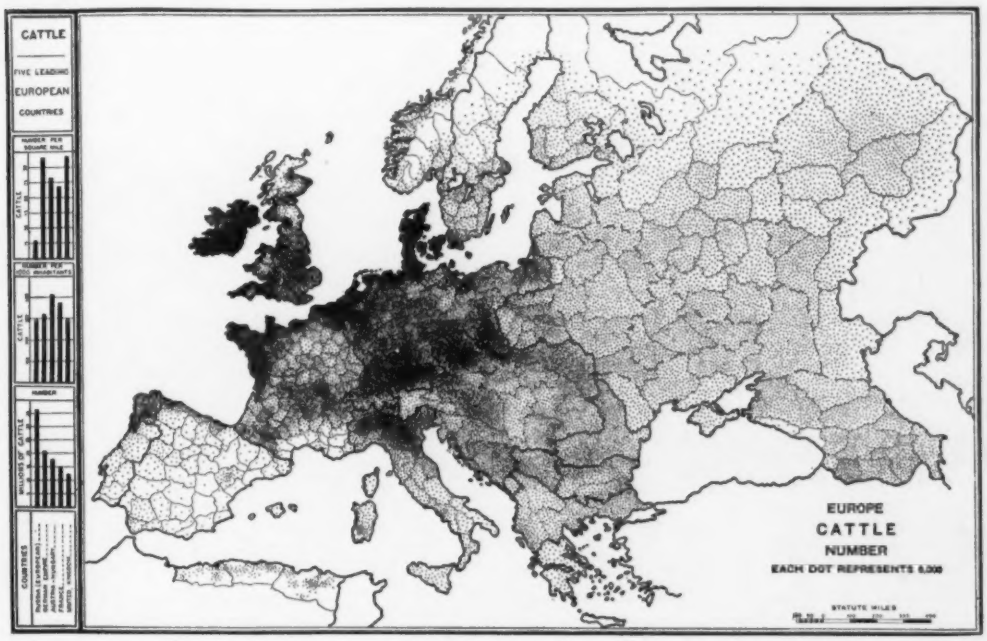

FIGURE 12.—The distribution of cattle in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

	Per Cent		*Per Cent*
Great Britain	66	Esthonia	69
Belgium	39	Latvia	77
Holland	58	Austria	65
France	41	Hungary	31
Denmark	46	Jugo-Slavia	51
Germany	45	Rumania	15
Finland	73	Italy	57

In all comparisons between agricultural regions in Europe and in America, it must be remembered that artificial factors, barriers, and favorable or un-

favorable conditions tending to modify the effect of the natural factors, are set up in the many states of Europe as a consequence of the economic and political boundaries established because of the racial, religious, linguistic, or historical likes and dislikes; whereas in America, with its remarkable economic, political, and social unity, the natural physical and economic factors may work almost unaffected. France is a striking example of successful stimulation by a high import duty on foodstuffs of high wheat production under conditions not everywhere naturally favorable, enabling the French wheat-growing farmer to compete successfully with small-grain farmers throughout the world where natural conditions favor high production at lower cost.

In the west central portion of the oats province, of the rye province, of the two-row barley province, and of the sugar-beet province, increased dairying, poultry and hog-raising, and truck-farming have led to increased production of forage and root-crops. This interesting transition in the agriculture of the small-grains provinces fundamentally defined by natural physical conditions, is leading to modified regional boundaries due to the influence of economic factors arising from the development of manufactures and commerce (Fig. 13).

Throughout the world, wherever the part of the population engaged in manufacturing, commerce, and other non-agricultural pursuits, tends to increase more rapidly than the part producing food and raw materials, this same transformation takes place, and as transportation and communication are perfected this same tendency is accentuated. Conurbations of people engaged in industry and requiring food, fuel, clothing, and raw materials are developing in many parts of the world, the most notable of Europe being the upper Po basin, the middle Rhone basin area, the Barcelona textile district, the Moscow textile center, and the Bergslagen iron center of Central Sweden.

FIGURE 13.—Holstein dairy cows in an alfalfa field of the south central plain of Skåne, Sweden. When the cows are not stall-fed through the summer, they are tethered in the fields and moved as they crop the forage too closely. All the land in this intensive dairy region is improved. (Courtesy of Hasse W. Tullberg.)

AGRICULTURAL REGIONS OF EUROPE

A KEY TO THE LAND UTILIZATION MAP AND THE AGRICULTURAL REGIONS MAP OF EUROPE

Olof Jonasson

I. COLD DESERT DEATH ZONE (some grazing, especially by reindeer.)

1. TUNDRA REGION

Pasture land

1. Iceland tundra. (Characterized by sheep grazing).
2. Continental tundra.
3. Spitzbergen, Franz Josef Land, Novaya Zemlya tundra.

II. COLD TRANSITION ZONE.

2. CONIFEROUS REGION, without crops (characterized by grazing, especially by reindeer, some forestry and fishery).

a. Polar coniferous subregion.

Pasture-forest land

1. The main area.

b. Alpine coniferous subregion.

1. The Scandinavian mountains.
2. Northern Urals.

III. TEMPERATE OR SMALL GRAINS ZONE.[1]

3. DAIRY (with swine, poultry and horses) HAY (and oats), AND ROOT CROPS (potatoes, sugar-beets) REGION. (The characteristics here are those associated with the most intensive agriculture, including truck-farming. This region practically coincides with the principal manufacturing region of Europe.[2])

a. Dairy, hay and sheep (mutton) subregion (Humid N. W.).

British Isles

Crop-pasture land

1. Northeastern Ireland. (Also flax for fiber and the dairying very intensive).
2. Eastern Scotland Lowland. (Root-forage crops very intensive).
3. Eastern Scotland—coastal area.
4. Northeastern England—coastal area.
5. Central England—river basins.
6. Southern and southeastern England—coastal area.
7. Northwestern England—coastal intensive dairying area.

Pasture-crop land

8. Central Ireland Lowland.
9. Western Scotland Lowland.
10. Eastern England—marshlands.
11. Southern England—uplands.

Pasture land

12. Northern Ireland—highlands.
13. Southern Ireland—highlands.
14. Southern Scotland and southern England—highlands.
15. Central England—upland. (This area practically coincides with the most intensive manufacturing district).
16. Wales—highlands.

The Continent

Crop land

17. Netherlands—"polder" sections (intensive dairying districts extend into Belgium. Also floriculture and flax for fiber).
18. Germany—"polder" section (intensive dairying district).

Crop-pasture land

Brittany and Normandy—dairy, potato, and buckwheat area sub-divided into

19. Northern portion with wheat, barley, and incidentally apples.
20. Southern portion with rye, and incidentally root-forage.
21. Southern Jutland—interior area of oats and rye.

Pasture-crop land

22. Netherlands—marsh section of intensive dairying.
23. Germany—marsh section of intensive dairying.

Pasture land

24. North Sea—continental dune area[3] (one to five miles wide).

[1] In contrast to the subtropical, or Mediterranean fruit, zone where, of the small grains, practically only barley and wheat are grown.

[2] According to Sten De Geer's studies of the geographical distribution of the principal manufacturing region of Europe. Sten De Geer: "Oceanernas Trafiklinjer," Karlstad eller "Aftonbladets Karta," Stockholm.

[3] This dune area also continues more or less along the coast of the Baltic Sea to the vicinity of Riga, but from the point of view of the use of the land, that part is not so important, because, as is well known, the very sandy soils of North Germany are inherently less productive, and inhabited by a relatively sparse population, except some cities, of which the location and development are traceable to their being at the mouths of navigable rivers connected by canals.

b. Two-row barley and dairy subregion,[4] with wheat, oats, and root-forage also very characteristic.

Crop land

1. Eastern England—barley, wheat, and root-forage area.

Western Baltic—intensive dairying area (with barley, wheat, root-forage and sugar-beets), subdivided into

2. Denmark-Germany—coastal area.
3. Danish Islands.
4. South Sweden—plain (Skåne).

c. Sugar-beets, wheat, and dairy subregion.

Crop land

1. France-Belgium—sugar-beet and wheat area.
2. Saxony—sugar-beet and wheat area.
3. Upper Silesia—sugar-beet and wheat area.

d. Small grains, dairy, and tree-fruits—Interior subregion (hops are also characteristic).

Crop land

1. West Central Germany—upland.
2. Moselle basin—(Moselle wine is also characteristic).
3. Saar upland area.
4. Rhine Graben—(Rhine wine and tobacco are also characteristic).
5. Switzerland—agricultural high plateau.
6. Swabia—portion of the Bavarian high plateau.
7. Franconia—portion of the Bavarian high plateau.
8. Bohemia Plain of Bohemian basin (sugar-beet is also characteristic).
9. Moravia Plain of Bohemian basin (sugar-beet is also characteristic).

Crop-forest land

10. Swabia-Franconia—highlands of the Bavarian high plateau.

Forest-crop land

11. West Central Germany—upland mountains.
12. Vosges—highland.
13. Black Forest—highland.
14. Bohemia border highlands.
    (a) Fichtel-Gebirge with Thüringer Wald.
    (b) Böhmer Wald.
    (c) Erz Gebirge.
    (d) Sudeten.

Crop-pasture land

15. Bohemia-Moravia—hilly upland of Bohemian basin.

e. Rye, potato, and dairy subregion (eastward dairying gradually becomes less important).

Crop land

1. North German—sandy plain.
2. Upper Oder—plains.

Crop-pasture[5] *land*

3. Belgium-Netherlands—sandy plains (the "Geest").
4. Limburger Heath.
5. Bourtanger Moor and Wietings Moor.
6. Lüneburger Heath.
7. Mecklenburg Lake plateau.
8. Pomerania Lake plateau and Tucheler Heath.
9. Masuren-land and Johannesburger Heath.

4. CENTRAL WHEAT, WINE AND FRUITS REGION with dairying increasingly important westward.

a. Hilly uplands subregion.

Areas west of the Alps[6]

Crop land

1. Southwestern France—millet and wheat area.
2. Garonne basin (Bordeaux wine and tobacco are also characteristic).
3. Western central France—barley, buckwheat, and wheat area.
4. Southern Paris basin—wheat area.
5. Champagne wine area.
6. Upper Rhone-Saone basin (potatoes and peaches are also characteristic).

Crop-forest land

7. "Central massive"—rye and buckwheat area (potatoes and sheep are also characteristic).

Crop-pasture land

8. Loire basin (wine is also characteristic).
9. Southwestern France—wheat area.

[4] The remainder of the two-row barley region consists of the Swedish islands (Öland and Gotland) and the Esthonian islands (Ösel and Dagö) together with the coastal lands south of the Gulf of Finland. Because of the physical conditions, especially the thinness of the soil, which practically coincides with the Cambro-Silurian plain, together with certain economic circumstances, such as the greater distance to the market in the main manufacturing region, dairying gradually gives way to a more extensive type of pasture. The market of Petrograd, however, causes an increase of dairying in the eastern portion of this area.

[5] During the last centuries these areas have been planted with coniferous forest but still agriculture and pasture dominate forestry.

[6] The division of France into agricultural areas is mainly based upon Michel and Knapp's statistical map "Les Céréales en France" but on account of difficulties in finding suitable names for some of the areas, such areas have been named only from the most characteristic and important crops of the section.

10. Northeastern France—upland extending into Belgium and Germany (rye and oats are also characteristic).
11. "Côte d'Or"-"Langres"—upland (the Burgundy wine is also characteristic).

Forest-crop land

12. Jura Mountains.

Pasture-crop land

13. Biscay dunes and marshes—the "Landes" is the portion south of the mouth of the Garonne river. (Millet and rye are characteristic).
14. Dombes Lake plateau.

Areas east of the Alps to the Black Sea (corn also characteristic).

Crop land

15. Little Hungary plain (sugar-beet is also characteristic).
16. Eastern Alps transition area (rye and barley are also characteristic).
17. Bulgaria plain (rye, barley, and sheep are also more characteristic than of the Rumania corn and wheat plain).

Forest-crop land

18. Bakony forest (wine, hogs, and oak forests are characteristic).

Forest-pasture land

19. Bihar highlands.

Pasture-crop land

20. North Balkan—upland (sheep, goats, mules and asses are characteristic for the domestic animals here as well as for all the Mediterranean zone. Corn is also characteristic).

Russia

Crop land

21. Caucasus—wine, tobacco and wheat area.

Crop-pasture land

22. Crimea peninsula north of the Yaila Mountains. (The wheat is principally winter wheat in this area, as well as for the whole region).
23. Caucasus—winter wheat area.

b. Major-mountains subregion.

Forest-pasture land Portions of the

1. Pyrenees-Cantabrian mountains.
2. Alps.
3. Carpathians.

Forest land Portion of the

4. Caucasus.

Pasture land (These constitute a high percentage of the Alpine sections).

5. Pyrenees.
6. Alps.
7. Carpathians.
8. Caucasus.

5. CORN AND WHEAT REGION with dairying and pork production increasingly important westwards.

a. Biscay subregion.

Crop-pasture land

1. Northwestern Iberian corn area (rye and potatoes also characteristic).
2. Southwestern France corn area.

Crop-forest land

3. Cantabrian slopes corn area (apples are also characteristic).

b. Lombardy subregion. (Western part more industrialized, with more intensive agriculture with dairy production. In this portion is produced the only rice grown in Europe. The lower portion is characterized also by the production of hemp, sugar-beet, wine and hay).

Crop land

1. Central corn area, with
2. Surrounding wheat area.

c. Hungary subregion.

Crop land

1. Trans-Danubian—corn and wheat area.
2. Central corn area.
3. North central wheat area (tobacco is also characteristic).

Crop-pasture land

4. Transylvania—corn and wheat area.

d. Rumania subregion.

Crop land

1. Central wheat area.

Crop-pasture land

2. Surrounding wheat and corn.[7]
3. Northern Dobruja-upland area.

Pasture land

4. Danube delta.

[7] Here as well as upon the plain, winter wheat in contrast to the spring wheat region of Russia.

e. Caucasus subregion.[8]

Pasture-crop land

1. Central corn area.

Pasture land

2. Surrounding wheat area.

f. Trans-Caucasus subregion[8] (in Asia, wine and tobacco also characteristic).

Crop-pasture land

1. Central corn area.

Pasture-crop land

2. Surrounding wheat area.

6. HAY AND PASTURE REGION, practically without grain production.

(Fjorded districts of Northwestern Europe.)

(The summers are too wet and too cool in general for the profitable growing of crops. To some extent, however, there is some production of oats, barley and potatoes. In this area in Iceland only potatoes are grown. Although there is very little forest, the northern portions, bordering and contrasting with the treeless Alpine and tundra districts, have been classified as pasture-forest land.)

Scotland and nearby islands.

Pasture-crop land

1. Northeastern Scotland—coastal area.
2. Orkney Islands.

Pasture land

3. North Scotland—highlands.
4. Hebrides.
5. Shetland Islands.
6. Färoe Islands.

Norway

Crop-pasture land

7. Southwestern Norway or Jaedren area.
8. West central Norway or Trondjem area.

Pasture-crop land

9. Southern Norway area.
10. Western Norway between the Trondhjem and Jaedren areas.

Pasture-forest land

11. Northwestern Norway.

Iceland

Pasture-forest land

12. Southwestern Iceland—coastal area.

7. POLAR-BARLEY REGION, with coniferous forests dominant.

Scandinavia

Crop land

1. Central North Sweden or Jämtland Silurian plateau.

Forest-crop land

2. North Bothnian Gulf—coastal area.

Forest-pasture land

3. Inland coniferous forest area of the Scandinavian type.

Russia

Forest-pasture land

4. Inland coniferous forest area of the Russian-Siberian type.

Forest land

5. Northeastern Russia—coniferous forest area.

8. OATS REGION, with mixed forest increasingly dominant eastward.[9]

a. Scandinavia-Baltic oats, rye and dairy subregion.

Scandinavia

Crop land

1. Oslo—area.
2. West Gothland—plains.
   (a) Coastal district.
   (b) Lake Vänern district.
3. East Gothland—plain.
4. Southeastern Sweden—coastal plain.
5. Lakes Mälaren and Hjälmaren district.
6. South Finland—coastal plain.
7. Sweden Islands (Öland and Gotland). Crop areas.

Crop-forest land

8. South Sweden—highland.
9. Central Sweden—highlands.
10. Finland Lake-Plateau, southern part, and southwestern coastal area.
11. Åland Island.
12. Bornholm Island.

Crop-pasture land

13. Northern Jutland area.
14. Northeastern Götland.

Pasture-crop land

15. Western Jutland heath.

Pasture land

16. Northwestern Jutland dune area.
17. Öland Island—southern central area ("Alvaret").

Forest-crop land

18. Finland Lake-Plateau, northern part.

Baltic States

Crop land

19. Baltic plain.

Crop-pasture land

20. Baltic Islands (Ösel and Dagö).
21. South Finland Gulf—coastal area.

[8] In this subregion pasture is dominant, but there is also some agricultural production, which is therefore used to designate it.

[9] This mixed forest gradually merges eastwards into a coniferous forest.

b. Oats, rye and flax (fiber) subregion of Russia.

Crop-forest land
1. Western main area, with
2. Valdai upland.

Forest-crop land
3. Eastern main area, with
4. Southern Ural.

9. RYE AND BUCKWHEAT REGION OF RUSSIA, POLAND AND THE BALTIC STATES, with hardwood forest. Some flax is also grown. It is also the main source of Russian hemp. As a rule rye is dominant over oats.

Crop-forest land
1. Main area, with

Forest-crop land
2. Latvia-Lithuania Lake-Plateau, and
3. Pripet marshes.

10. SUGAR-BEET AND WINTER-GRAIN (WHEAT AND RYE) REGION OF RUSSIA. (Sunflowers—for seed—tobacco, millet and oats are also characteristic.)

Crop land
1. Main area, with
2. Kiev intensive sugar-beet area, and
3. Kharkov intensive sugar-beet area.

11. SPRING-WHEAT REGION OF RUSSIA. (Flax (for seed) is also characteristic).

Crop-pasture land
1. Entire area.

12. SUBTROPICAL BARLEY REGION OF RUSSIA, with natural grasslands dominant. From the viewpoint of the small grains, this region is similar to the semi-arid barley, wheat, olives and pasture region of the Mediterranean, but the topography is more nearly level and the climate, soil, and natural vegetation has more of the characteristics of a semi-desert land.

Pasture-crop land
1. Main area, with
2. Caucasus—barley and pasture area (extends into Asia).

IV. SUBTROPICAL OR MEDITERRANEAN FRUIT ZONE.[10]

13. HUMID OR SUB-HUMID WHEAT AND MEDITERRANEAN FRUIT REGION.

a. Humid coastal citrus fruit, wine and wheat subregion.

Iberian Peninsula

Crop land
1. Lower Andalusia area.
2. Malaga-Almeria "Huertas" (Garden) area. (Malaga wine originated here).
3. Valencia—intensively irrigated citrus area.

Crop-pasture land
4. Portugal—lowland area. (Port wine originated here).
5. Gibraltar—coastal area.
6. Catalonia—coastal area. (Most of the grape exports from Spain come from here. This area, especially in and around Barcelona, is more industrialized than any other in Spain).

Crop-pasture land
7. Sierra Nevada. (The relatively high mountain precipitation makes the valleys suitable to fruit culture and so agriculture becomes more important than forestry).

Pasture-crop land
8. Catalonian Mountains.

France

Crop-pasture land
9. Lyons—coastal grapes area.
10. French-Italian Riviera. (This extends into Italy with the olive as characteristic).
11. Corsica—coastal area.

Pasture land
12. Lower Rhone grassland area. (Sheep are characteristic).

Italy

Crop land
13. Arno basin.
14. Naples plain. (Hemp and corn are also characteristic).
15. Palermo—intensive citrus area ("Golden Horn").
16. Catania-Messina—intensive citrus area.
17. East Italy—coastal area. (Some corn is also grown).
18. Upper Tiber and Liri area.

Crop-pasture land
19. South Italy—coastal area. (The olive is also characteristic).
20. Southeastern Italy—coastal area. (Olives with winter oats cut for hay also characteristic.)
21. Istrian area, extending into Jugo-Slavia.

[10] Wheat, barley, beans and sheep are also very characteristic for this zone, but in order to get a short term to apply to this zone also, the name Mediterranean Fruit Zone is used in addition to the climatic designation. The term Mediterranean fruits applies particularly to the citrus fruits, or what is called in Europe "southern fruits."

22. Western and northeastern Sicily areas.

Pasture-crop land

23. Tuscany upland.
24. "Campagna Romana."

Pasture land

25. West Central Italy—Maremme area.

Balkans

Crop-pasture land

26. Southeastern Balkan—coastal area.

Pasture-crop land

27. Western Greece—coastal area.

Pasture land

28. Dalmatia—coastal area.

Russia

Crop land

29. Crimea peninsula—coastward slopes of the Yaila Mountains.

Pasture land

30. Southwestern Caucasus—coastal slope. (Tobacco is also characteristic).

b. Sub-humid interior wheat and pasture subregion.

Iberian Peninsula

Crop-pasture land

1. Old Castilian high plateau—wheat area.
2. Old Castilian high plateau—rye area.

Pasture-crop land

3. Portugal upland.
4. Middle Tagus basin.
5. Middle Guadiana basin.[11]

Pasture-forest land

6. Castilian dividing range.

Pasture land

7. Sierra Toledo dividing range.
8. Sierra Morena.

France

Crop-forest land

9. Provence upland.

Pasture-crop land

10. Middle Rhone basin. (Millet is also characteristic).

Pasture land

11. Corsica—upland.

Italy

Crop-pasture land

12. Apennines-Lombardy transition area. (Citrus fruits and wine are characteristic).
13. Alps-Lombardy transition area. (Citrus fruits and wine are characteristic).

Pasture-crop land

14. Apennines—upland.

Pasture land

15. Sicily—upland.

The Balkans

Pasture land

16. South Balkan uplands.

14. SEMI-ARID BARLEY, WHEAT, OLIVES AND PASTURE, OR SUBTROPICAL BARLEY, REGION.

Iberian Peninsula

Crop land

1. Murcia intensive citrus fruit area.

Crop-pasture land

2. Upper Andalusian lowland.

Pasture-crop land

3. Coastal semi-arid areas.
4. New Castilian semi-arid area.
5. Aragon basin.
6. Balearic Islands.

Pasture land

7. Sierra Murcia.
8. Sierra Teruel.

Italy

Pasture-crop land

9. South Italy—semi-arid area.
10. Sicily—southeastern coastal area.
11. Northern and Western Sardinia—coastal slopes.

Pasture land

12. Sardinia—upland.

The Balkans

Crop-pasture land (Tobacco also characteristic).

13. Attica and Euboea—hilly lowland and Beoetian plain.
14. Thessaly—plain and hilly upland.
15. Macedonia—plain and hilly lowland.
16. Crete—northern coastal area.

Pasture-crop land

17. Southeastern Greece—coastal area.
18. Crete—upland.

V. DRY TRANSITION ZONE (characterized by some grazing of cattle, horses and sheep).

15. STEPPE REGION, agriculture negligible.

Pasture land

1. Entire area.

VI. DRY DESERT DEATH ZONE (with little pasture).

16. DESERT REGION.

Pasture land

1. Western main area.
2. Eastern main area.
3. Volga delta.

[11] This basin is practically the same as the Oretania region as given by Dantin Cereceda in "Regiones Naturalles de Espana," Madrid, 1922.

THE AGRICULTURAL REGIONS OF EUROPE

THE DISTINCTIVE DIVISIONS ARISING FROM TYPES OF AGRICULTURE AND ASSOCIATED INDUSTRIES

Upon the physical[14] and economic bases thus established and within the limits thus defined, the following agricultural regions of Europe are distinguished and described:

Cold desert death zone.
  Tundra region.

Transition zone.
  Polar coniferous region, no agriculture.

Temperate or small grains zone.
  Dairy, hay, and root-crops region.
    Hay, dairy, and sheep subregion.
    Two-row barley and dairy subregion.
    Sugar-beet, wheat, and dairy subregion.
    Small grains, dairy, and tree-fruit subregion.
    Rye, potato, and dairy subregion.
  Central wheat, wine, and fruit region.
    Hilly uplands subregion.
    Major—mountains subregion.
  Corn and wheat region.
    Biscay subregion.
    Lombardy subregion.
    Hungary subregion.
    Rumania subregion.
    Caucasus subregion.
    Trans-Caucasus subregion.
  Hay and pasture region, practically without grain production.
  Polar barley region, with coniferous forest dominant.
  Oats region, with mixed forests increasingly dominant eastward.
    Scandinavia-Baltic oats, rye, and dairy subregion.
    Russia oats, rye, and flax subregion.
  Rye and buckwheat region.
  Sugar-beet and winter-grains region.
  Spring-wheat region.
  Subtropical barley region.

Subtropical or Mediterranean fruit zone.
  Humid and sub-humid wheat and Mediterranean fruit region.
    Humid coastal citrus, wine, and wheat subregion.
    Sub-humid interior wheat and pasture subregion.
  Semi-arid barley, wheat, olives, and pasture, or subtropical barley, region.

Transition zone.
  Steppe region, agriculture negligible.

Dry desert death zone.
  Desert region.

That these divisions can not be altogether satisfactory is self-evident, but only in very few places have their boundaries been arbitrarily fixed, or determined by unsatisfactory data. Europe has been more thoroughly studied than any other continent, and fairly accurate information, both recent and historical, is available for almost every division; but in its entirety, and in its relation to the world as a whole, Europe is not so well understood.

Consequently the differentiation of Europe into regions as herein presented must be regarded merely as a preliminary investigation to attract the attention and interest of other workers in the geographic field throughout Europe, and to stimulate coöperative research whereby a more adequate knowledge of the agricultural regions of Europe may in due time be secured. Except in Engelbrecht's and a few other highly generalized studies by which the regions are determined by administrative boundaries, and of which the statistical units are not sufficiently large for the desired purposes, such knowledge, though sorely needed, has not been assembled or made available.

[14] In this enumeration of the agricultural regions of Europe, with their several subregions, it is not practicable to describe in detail the distinctive physical conditions of physiography, climate, and soil upon which they are based. Only as one or the other factor is particularly significant, or decisive, is it definitely referred to. For their careful and more exhaustive treatment of these factors the following publications are recommended:

1. A. K. Lobeck, "Physiographic Diagram of Europe," 1923.
2. Julius Hahn, "Handbuch der Klimatologie," 1908.
3. W. Köppen, "Die Klimate der Erde," 1923.
4. E. Ramann, "Bodenkunde," 3rd Edition, 1911.
5. G. D. Glinka, "Die Typen der Bodenbildung," 1914.

COLD DESERT DEATH ZONE

The death zone of the world due to too low temperature, occupies only a little strip of the European peninsula. Because of the influence of the Gulf Drift this zone, so wide in Asia, constitutes a mere wedge in Europe, cutting off only a narrow strip of the northwestern coast. The islands in the Arctic sea—Spitzbergen, Novaya Zemlya, and Franz Joseph's Land—belong to this zone, and most of Iceland. Iceland, however, bathed by the mild Iceland eddy, a branch of the Gulf Drift, has an important sheep-grazing industry; and in its southwest portion the conditions for vegetation are so favorable that a low type of forest has developed. Because of these facts the southwest portion of this island has accordingly been separated and included in the zone of transition toward the temperate or small grains zone.

THE TUNDRA REGION

As stated, the northwestern coastal strip of Europe and the Arctic Islands belong to the cold desert death zone. Here where the ground is always frozen to a considerable depth and melts only on the surface during the summer time, is the Tundra. The Tundra of Europe is a coastal plain mainly covered with marine deposits. Its rivers are almost useless for navigation because their sluggish lower courses remain blocked with ice long after their headwaters have melted. This is one of the chief reasons why these rivers can not serve as important outlets for the vast timber resources of their headwaters; and why so much of the land is flooded and consequently the low marsh-land type of region so extensive. The Tundra has some grassland of importance to the nomadic Mongolian types that maintain their reindeer culture upon it part of the year (Fig. 14).

FIGURE 14.—The Russian tundra about the White Sea; the dense low shrub is dwarf birch; the men are two Samoyedes, one of the Mongoloid types that roam over the Eurasian tundra. (From "Vegetationsbilder" by G. Karsten and H. Schenck, Jena, 1910.)

COLD TRANSITION ZONE

A transition zone of low forest succeeds the treeless, or almost treeless, Tundra before real coniferous forest begins, and physical conditions become possible for growing the small grains. The southern limit of this zone forms, consequently, the extreme northern limit for grain production and is, therefore, agriculturally very important, even though no sharp boundary can be drawn.

THE POLAR CONIFEROUS REGION WITHOUT AGRICULTURE

This constitutes the transition zone between the Tundra and the real coniferous forest. Like the Tundra, it is resultant upon high latitude, except its southern extensions along the crest of the mountains between Sweden and Norway in the west and along the Ural Mountains in the east, where high altitude produces a similar effect.

The alpine coniferous area is very similar to the foregoing region. It comprises those parts of the central European mountain mass where high altitude produces cold and drought prohibitive of agriculture. The extreme crests of these mountains are above tree-line; they are negligible in area, and unimportant.

TEMPERATE OR SMALL GRAINS ZONE

Most of Europe belongs to the small grains zone, which together with the Mediterranean fruit zone comprises the temperate and subtropical life zones of Europe. The relatively mild climate of west central Europe; its mild winters and its warm, but not hot, summers; its ample precipitation distributed rather evenly throughout the year; and its growing season practically coincident with the warmest months; all these favor the production of the small grains characteristic of the land utilization of the zone as a whole. The only significant exception is the southeastern section of Russia, and there chiefly the subtropical barley region. As stated before, this part of Russia, from the viewpoint of the small grains, is similar to the semi-arid barley, wheat, olives, and pasture region of the Mediterranean; but the absence of the other typical crops of the Mediterranean zone and its adaptability to small grain production because of its grassland character make it more characteristic of the small grains zone with which it is included.

THE DAIRY, HAY AND ROOT-CROPS REGION

This region includes the British Isles excepting the northern section, and some parts of northeastern France, Belgium, Netherlands, Denmark excepting northern Jutland and Bornholm, Germany, western Poland, and the plains of Switzerland, Austria, and south Sweden. Within the region the forests are confined almost entirely to the mountains of Germany and Czechoslovakia, and the more recently forest-planted sandy heath-lands of northern Germany; pasture and grazing lands become increasingly extensive toward the west as the physical conditions—maritime climate, heavy clay soils on the lowlands, rough topography, undrained swamps, dunes, and heaths,—and economic factors, like industrialism and concentrated population, become favorable (Fig. 15).

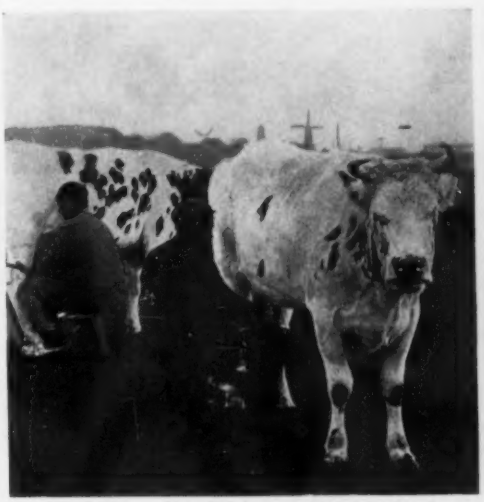

FIGURE 15.—The Holstein-Friesian cows that have made the intensive dairy industry of the Netherlands renowned throughout the world. (Courtesy of the Keystone View Co.)

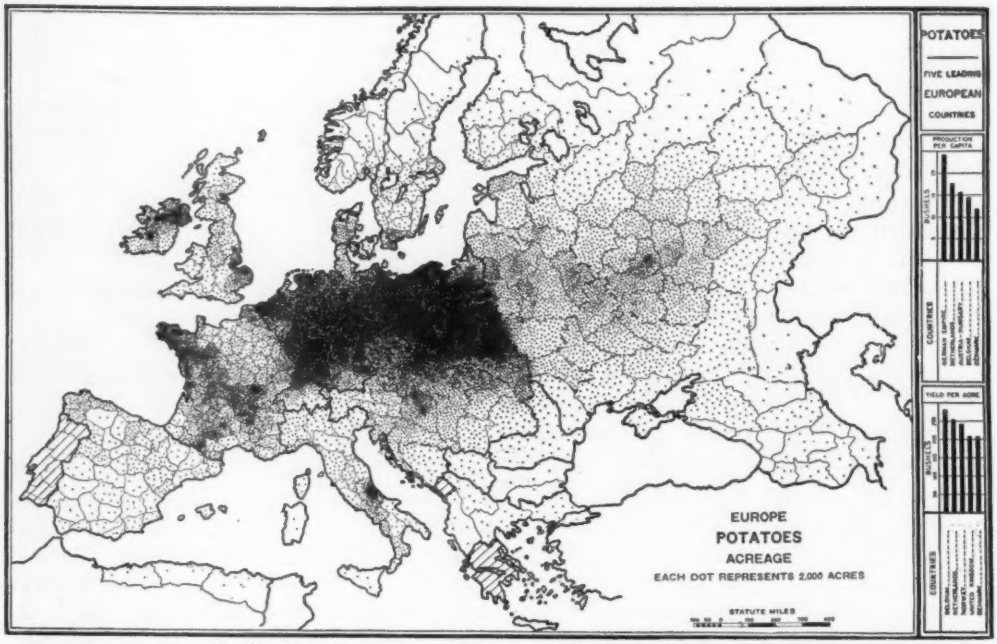

FIGURE 16.—The distribution of potatoes in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

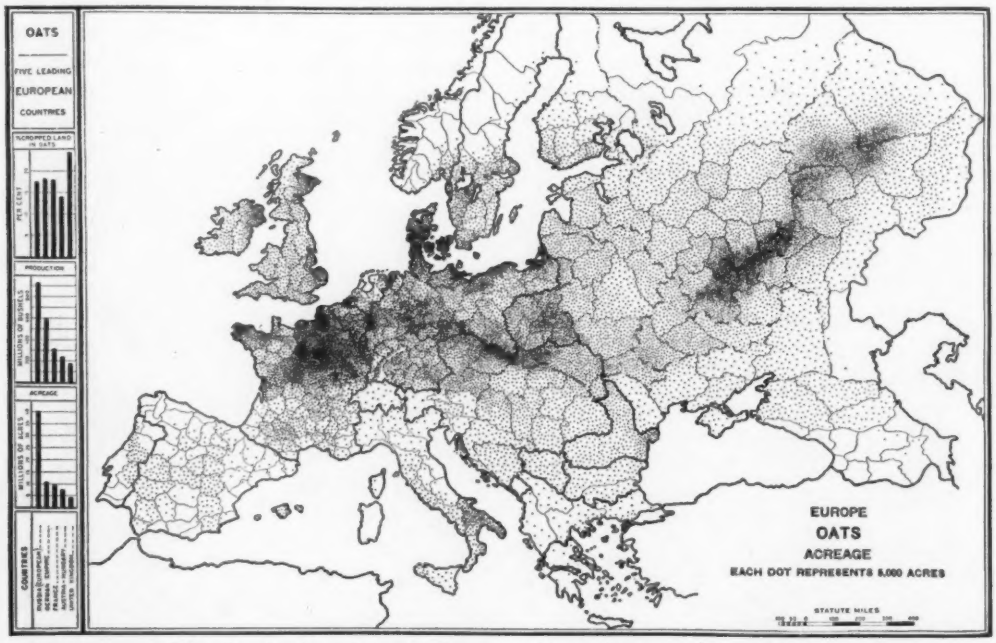

FIGURE 17.—The distribution of oats in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

The landscape emphasizes the pasture aspect of the region, because much of the improved land—which constitutes roughly one-third the area—is devoted to forage crops. As in all regions of concentrated population the domestic animal density is great, and a large part of the products of the intensively culti-

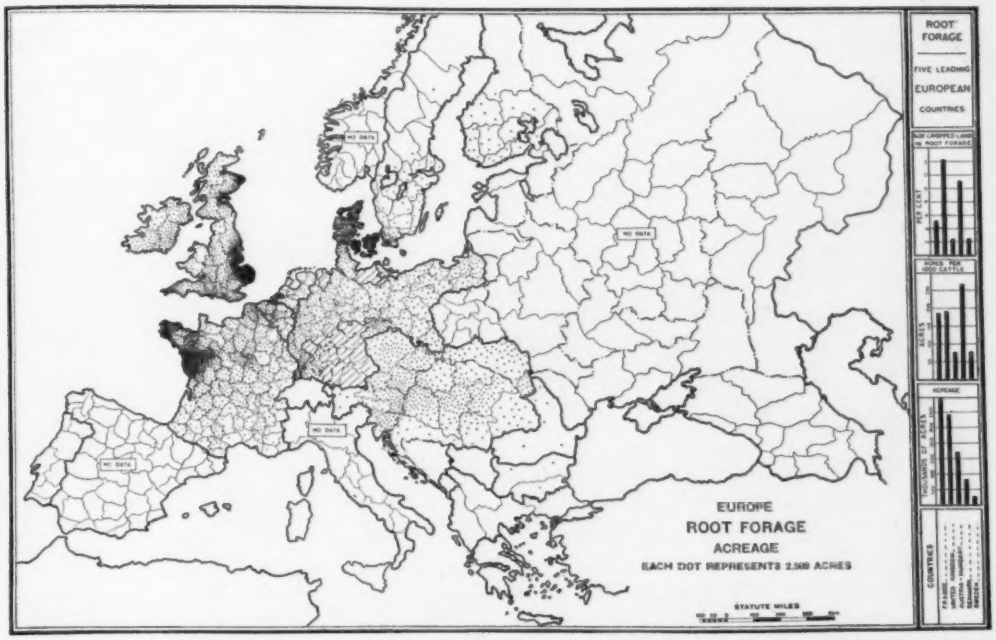

FIGURE 18.—The distribution of root crops in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

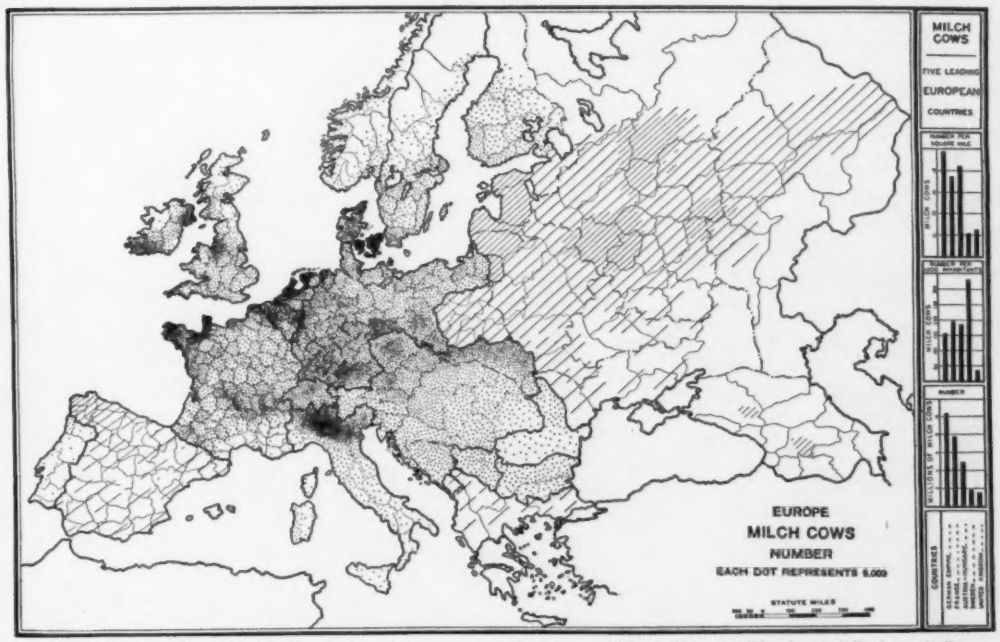

FIGURE 19.—The distribution of milch cows in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

vated areas—potatoes, root-forage, sugar-beets, hay (including grain-forage of all kinds), oats, and two-row barley,—are used as feed for dairy and beef cattle, hogs, poultry, and horses. The cultivation of bread-cereals also becomes diminishingly important westward, except in France where the high import duty ar-

tificially stimulates wheat-growing, and on the northern plain of Germany, which grades into the great grain-producing plain of Russia (Figs. 16, 17, 18 and 19).

Marked distinctions within the regions of these characteristic crops permit a further differentiation into the subregions given: (1) hay, dairy and sheep subregion; (2) two-row barley and dairy subregion; (3) sugar-beet, wheat, and dairy subregion; (4) small grains, tree-fruits, and dairy subregion; and (5) rye, potato and dairy subregion.

Hay, Dairy and Sheep Subregion

The hay, dairy, and sheep subregion is located about the North Sea, where physical and economic conditions are especially suitable for profitable dairying. Besides the domestic animals typical for the main region, a great number of sheep for mutton are produced, particularly in England (Fig. 20). Generally speaking the

FIGURE 20.—A generalized representation of land utilization in Great Britain; approximately all the land west of the isohyet of 30 inches annual rainfall is pasture, while that east is cropland. (With some corrections based upon a sketch in "Grande Géographie," Paris, 1914.)

FIGURE 21.—Harvesting wheat on grainfields of Merrie England. (Courtesy of the KeystoneView Co.)

FIGURE 22.—From the fertile "polders" of Holland, with the canals and windmills and fair milkmaids so typical of the landscape.

isohyet of 30 inches or 750 millimeters divides the region fairly well into a western portion, including Ireland, the western half of England, Brittany, and Normandy, in which there is more than 50 per cent of the land in pasture,[15] and an eastern portion where grain becomes essentially important in the rotation systems as do also root-crops and forage to a minor degree, indicative of the most highly developed agriculture. This distinction depends not only on a lower rainfall, but upon a number of effectively associated factors of which the most important are the higher summer temperature, and the more level land of the more recent geologic formations, with their deeper and more fertile soil. An examination of a map showing the distribution of these conditions permits a

[15] The coincidence, in general, in the areas with moderate temperature between the isohyet of 30 inches and the line marking off the lands with more than 50 per cent of the land in pasture seems to be true throughout Europe.

FIGURE 23.—The intensive horticultural, dairying, and truck-growing section of Holland lies below sea level, the "polders." The polders gradually rise to marsh land above sea level but less than 35 feet above; the marshes in turn give way to the sandy, infertile Geest, with heath and peat-growth, more than 35 feet above sea level.

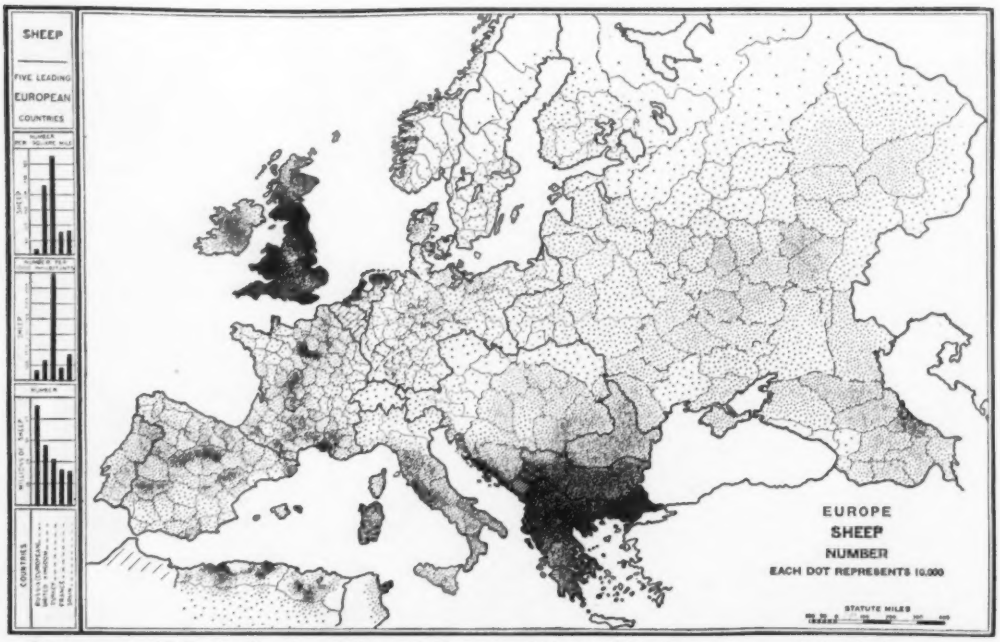

FIGURE 24.—The distribution of sheep in Europe. The English sheep are reared chiefly for mutton; the Balkan sheep largely for wool. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

correlation between them and the genetically associated location of cities, ports, and dense population near the coal, iron and clay deposits of the subregion (Fig. 21).

The western part of the British Isles, Brittany, and Normandy consist mainly of Archean highlands with characteristically rough topography, relatively thin and infertile soil, and relatively cold and wet climate—conditions unfavorable to grain production. Grasses, therefore, constitute the most important crop produced. In the valleys and lowlands of this division, dairying is important, and even on the thin soil of the uplands difficult of tillage, a short but nourishing grass growth provides pasturage for large flocks of sheep (Fig. 24).

From various viewpoints these highlands are similar to the hay and pasture region of northwestern Europe, without agriculture; but the more southerly location gives rise to better climate, soil, richer plant growth, and better agriculture, and these favorable conditions are accentuated by the shorter distances to the great market-places in the neighboring manufacturing and trade centers.

The Polders of Netherlands and Germany deserve special mention. The fertile alluvial materials of these lowlands, rich in organic matter, are now well drained by canals and pumping devices. Here on the lands below sea-level an intensive agriculture of the highest type is practiced, mainly floriculture, olericulture, and especially dairying (Fig. 22). Similar bordering lands above sea-level, the marshes which grade into the polders, are sometimes less well drained. Here crops are less important but dairying and stock-raising increase in both absolute and relative importance (Fig. 23).

Inland from this productive seaboard lie large tracts of higher and generally less fertile lands, known as the Geest, of which large areas consist only of sandy wastes overgrown with heather, undrained marshes where cattle are grazed, and almost non-productive peat-moors of relatively great extent. Dairying and the hay crops are of diminished importance upon the Geest; but rye and pota-

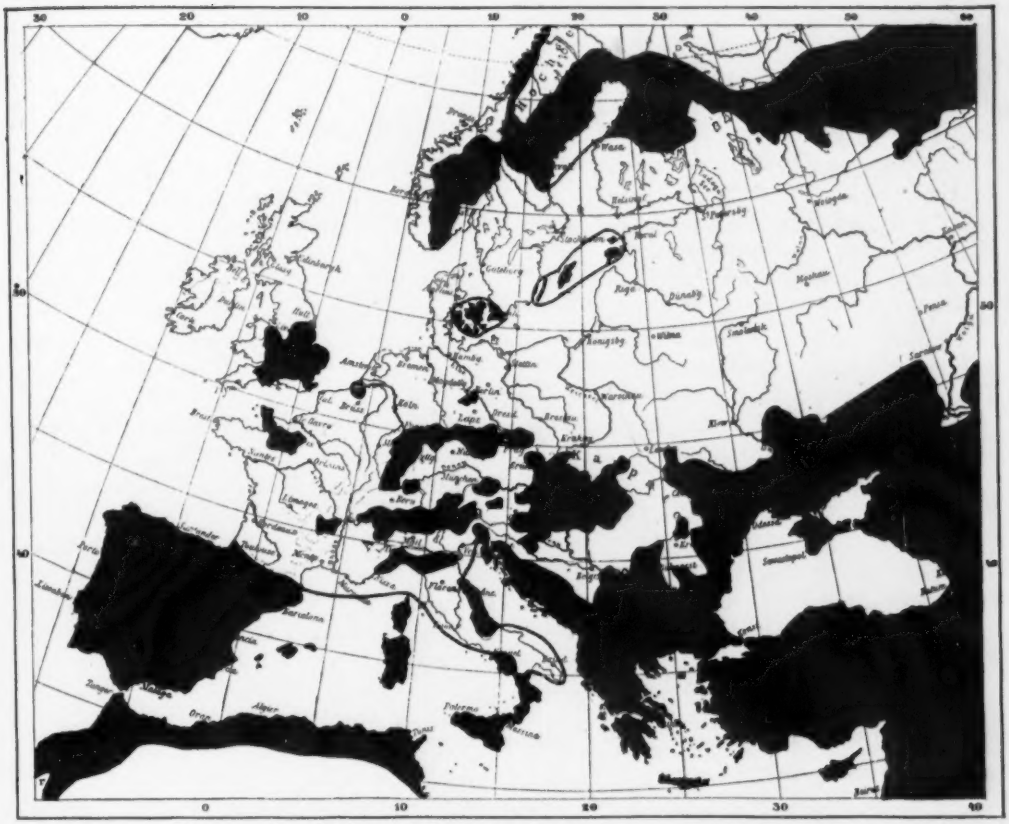

FIGURE 25.—The areas in solid black indicate dominance in acreage of barley over oats, based upon small statistical units. The three barley provinces indicated are as follows: 1. The polar barley province in the northern parts of Scandinavia and Russia. Similar physical conditions make barley dominant in the mountain sections. 2. The subtropical barley province in the Mediterranean section and southern Russia. Similar physical conditions make barley dominant in Hungary and Lombardy. 3. The two-row barley province in England, in the Danish, Swedish, and Esthonian Islands, and southern Sweden. Similar physical conditions make two-row barley dominant in Normandy, Netherlands, and southern Germany.

toes are significant, as they are in the whole of north Germany where conditions are similar. For this reason the Geest has been included with the rye and potato subregion.

Two-row Barley and Dairy Subregion

This division includes the only section of England where grain-growing is dominant, that which lies about The Wash. It includes, also, the Danish Islands, and the neighboring coastal plain of Jutland, south Sweden, and northwest Germany. The annual rainfall here is less than 25 inches. The Baltic portion of the subregion with its associated intensive agriculture is one of the most highly developed dairy sections in the world. Two-row barley and oats, which are always very closely related to the type of dairying with which swine production is combined, are, like wheat, characteristic for the whole subregion. In this same Baltic section the sugar-beet is also characteristic. Hence, two-row barley, oats, wheat, and sugar-beets are typical crops of an intensively developed dairy division of this kind.

Two-row barley (*Hordeum distichum*), should be clearly distinguished from the six-row barley (*Hordeum hexastichum*), the latter a bread-cereal characteristic of the polar barley region and probably also

of the main groups of the several barley species of the subtropical barley region, whereas the former, two-row barley, is grown, primarily as feed for hogs and for malt purposes almost exclusively in its own region, and to a considerable extent in the neighboring regions. From the standpoint of their botanical characteristics, their growth conditions, their economic relations, and their uses, these two species of barley are as distinct from each other as are wheat and rye, and might well be regarded as two equally different types of small grains (Fig. 25).

From the economic and agricultural point of view two-row barley is very similar to wheat in Europe. Like wheat it produces a high yield per acre and grows best in the medium-textured loam overlying the limestone of this subregion. In Europe this type of barley is sometimes even more profitably grown than wheat, particularly in this subregion, on the Swedish and Esthonian Islands, and the coastal plain south of the Gulf of Finland, all of which are included also in the two-row barley province.

The limestone from which the soil has been largely derived, belongs to the Cambro-Silurian and Cretaceous formations, the areal distribution of which, in this part of Europe, coincides very closely with this barley province; some definite relationship may exist between the two.

FIGURE 26.—Weeding a field of sugar-beets. An illustration of intensive application of labor. (Courtesy of the Keystone View Co.)

Sugar-beet, Wheat, and Dairy Subregion

Although sugar-beets are grown from the central Swedish plain (Ost Gothland) to southern Spain, the main production, about 90 per cent, is concentrated in a province (the sugar-beet and winter wheat province) extending south of, and parallel with, the rye and potato subregion and its continuation eastward as the rye and buckwheat region of Russia. The remaining 10 per cent of the production of sugar-beets in Europe is in the Baltic section (Danish Islands and the plain of Skåne in Sweden) of the two-row barley and dairy subregion, and in the Bohemian plain, the Moravian plain, the Little Hungarian plain, and the lower part of the Po basin, in all of which the soil material characteristically resembles that of the sugar-beet, wheat, and dairy subregion (Figs. 26, 27 and 28).

This province, however, does not extend as a continuous, homogeneous belt south of the rye region from the English Channel towards the Urals, but is broken up into five areas, where sugar-beet production is more concentrated. These are the French-Belgium portion, the Saxony portion, and the Upper Silesia portion, all three included in this subregion of the greater dairy region of northwest Europe, and the Kiev and the Kharkov portions which are part of the sugar-beet and winter grain region.

This subregion is, in general, located in the peripheral portion of the area affected by the farthest extension of the continental ice sheet, and wherever there were suitable conditions for the deposition of finer sediments over more extensive areas. Thus the France-Belgium sugar-beet area is located in the lower sections of the Paris basin, and south of the sandy deposits (the Geest) in the Netherlands and Belgium; the Saxony, and Upper Silesia in the basins of the Elbe, and the Oder, respectively, and south of the Baltic plain which is more sandy and has

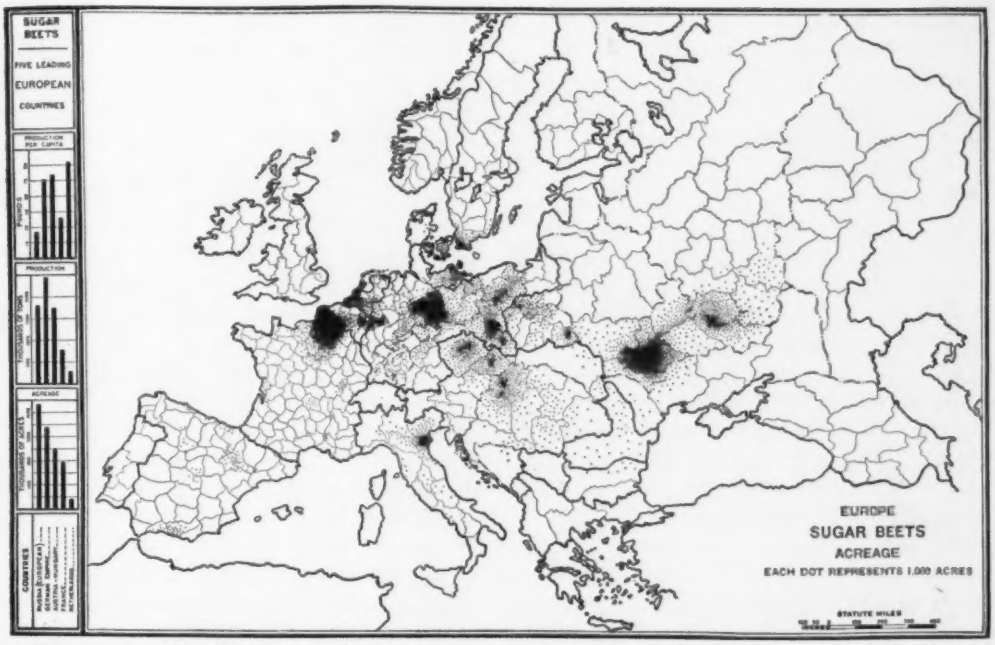

FIGURE 27.—The distribution of sugar-beets in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

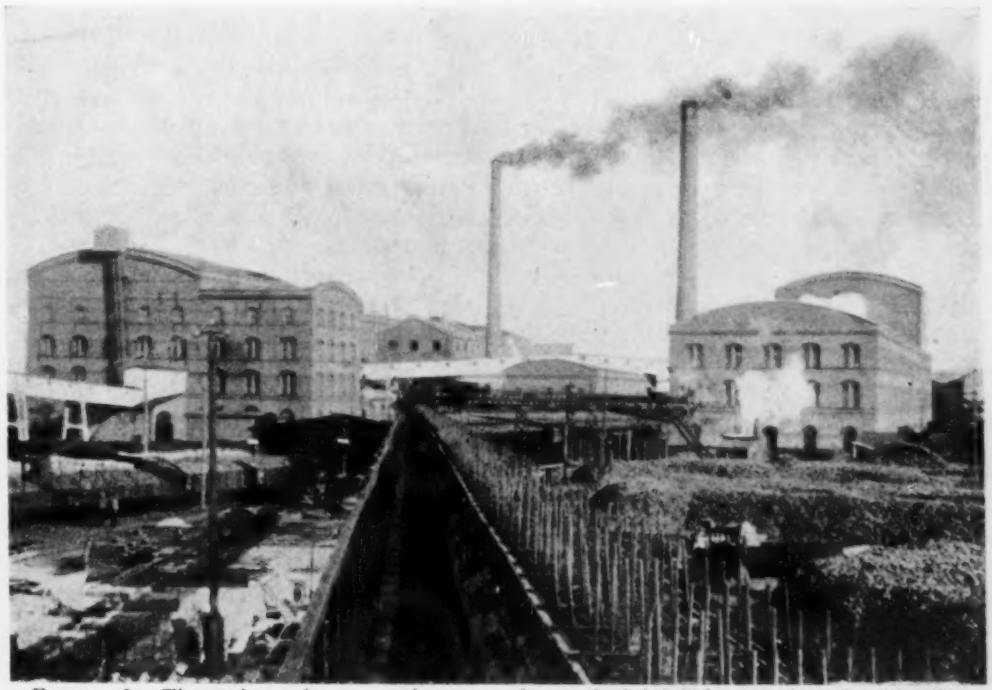

FIGURE 28.—The environs about a raw beet-sugar factory in Arlöf, Skåne, southern Sweden. These factories must be situated very near the fields so that the beets may be macerated and pressed as quickly as possible after digging, to conserve their utmost sugar content. In the sugar-beet harvest, every conveyance procurable is pressed into service to bring the beets from field to factory. The refineries need not be so near the fields. The raw beet-sugar factories operate only a short season; the refineries may run all year. (Courtesy of Hasse W. Tullberg.)

a great quantity of glacial debris from the Baltic terminal moraine. In a similar way, the two Russia sugar-beet areas are found in the basins of the Dnieper and the Donetz, respectively; and the less important sugar-beet area in Poland is found in the basin of the Vistula. The basins of the Weser and the Rhine extend through uplands in much of their upper and middle courses and hence the possibilities for the accumulation of the finer sediments which are found to the eastward did not exist. Fine wind-blown deposits or loess may also have played a rôle in the adaptability of the soil to sugar-beet growing throughout the region, as they certainly have done in the eastern sugar-beet areas.

Wherever sugar-beets and wheat are most extensively grown the terrane is underlain by a somewhat porous limestone which belongs in the main to the Cretaceous formation. The coincidence between distribution of limestone and of sugar-beets and wheat is striking. In the Russia sugar-beet sections, the soil materials, whether glacial sediments, wind deposits, or derivatives of the underlying limestones, have developed about Kharkov into a typical chernosem and about Kiev into a soil similar to the chernosem. In the sugar-beet sections in the west the soil is not so black as the chernosem, but is, however, much darker than in the bordering regions. This is true, especially, for the Saxony area, the most important one in the whole region.

Some have classified the soils here as chernosems, others as rendzinas (a term applied by Polish peasants to certain dark colored soils derived from limestone) which characteristically enough are found in Poland where many sugar-beets are grown in the valley of the Vistula. Some investigators are disposed to consider these soils as produced entirely by local conditions. Evidences of ancient climatic factors that must have had much to do with the development of dark colored soils in these areas are found in the form of certain fossils, especially abundant in the vicinity of Magdeburg, which indicate a drier climate in that portion of Europe than that which exists at the present time. It seems that this drier time would be comparable to the warmer subboreal climate of post-glacial time.

The fertile, dark-colored, fine-textured, loamy soil of the sugar-beet sections—the best agricultural land of Europe—like the even more fertile soils of the American corn belt, are thus due to a fortunate combination of favorable physical conditions—the high summer temperature, the low winter temperature and consequent freezing of the soil to prevent erosion and leaching, and the relatively low and evenly distributed rainfall (probably even more marked in past ages); their derivation from the finer glacial detritus, wind-blown loess, and the Cretaceous limestones and other sedimentaries from which mineral fertilizers have been obtained; and to their level surface and modern, adequate drainage. As a consequence, practically every acre of this fertile land is improved; and the highest, and most intensive, use of the land, dairying and associated types of agriculture, here finds a most profitable market for its products in the great combination of industrial and commercial industries and interests centered about the coal and iron deposits.

Other important factors entering into the physical conditions of the sugar-beet, wheat, and dairy subregion are its more interior position in the European peninsula, its relatively high summer temperature (63 to 75 deg. F.), and its comparatively low rainfall.

The sugar-beet production of Europe is much more important than in America, where the great extensively-operated sugar-cane plantations of Cuba and the other Antillean islands, supply the heavy American demand for sugar more cheaply than can the more intensively-cultivated beet-sugar fields; and like wheat-growing in France, sugar-beet production in America could not persist without a protective import duty. The American crop is only one fourth that of Germany

under normal conditions. Prior to the World War, Russia led in acreage, though her yield was low because of insufficient rainfall and unimproved methods of cultivation. With modern methods of tillage and the wider application of an adequate rotation system, the Russian yield may be considerably increased.

The soil of the France-Belgium section differs somewhat from that of the subregion in general in that the soils are considerably lighter-colored and probably somewhat less fertile. This lighter-colored soil has not been derived from glacial material and is consequently older; it has also been more leached and otherwise affected by higher temperature and heavier rainfall throughout the year.

The France-Belgium section coincides in the main with the coastal plateau of the Paris Basin, a wide and low tableland in the provinces of Artois, Picardy and Lower Normandy, underlain by chalk. It differs from the infertile chalk plateau of the so-called "Dry Champagne" in that it has a thin overlying layer of "limon" or clayey surficial derivative of chalk and limestone substratum, which is fertile, and retentive of moisture. Whereas the chalk plateau of Champagne is barren, and sparsely populated, the sugar-beet region is a prosperous and populous agricultural region where wheat is grown successfully as well as sugar-beets.

Rye, Potato, and Dairy Subregion

This subregion lies north of the sugar-beet subregion, and like it extends into Russia as a distinct region, the Russian rye and buckwheat region, (the two constituting the rye province), where dairying is less important, just as dairying is less important in the eastern portion of the dairy, hay, and root crops region (Fig. 29).

That this rye, potato, and dairy subregion is properly included within the great dairy region of northwest Europe is conclusively proved by E. Romer's excellent maps of Poland and contiguous lands which (despite his use of the relative, or percentage, method) show the close correspondence between the distribution of oats, potatoes, dairying, the population density, and the increased relative proportion of bread-cereal pro-

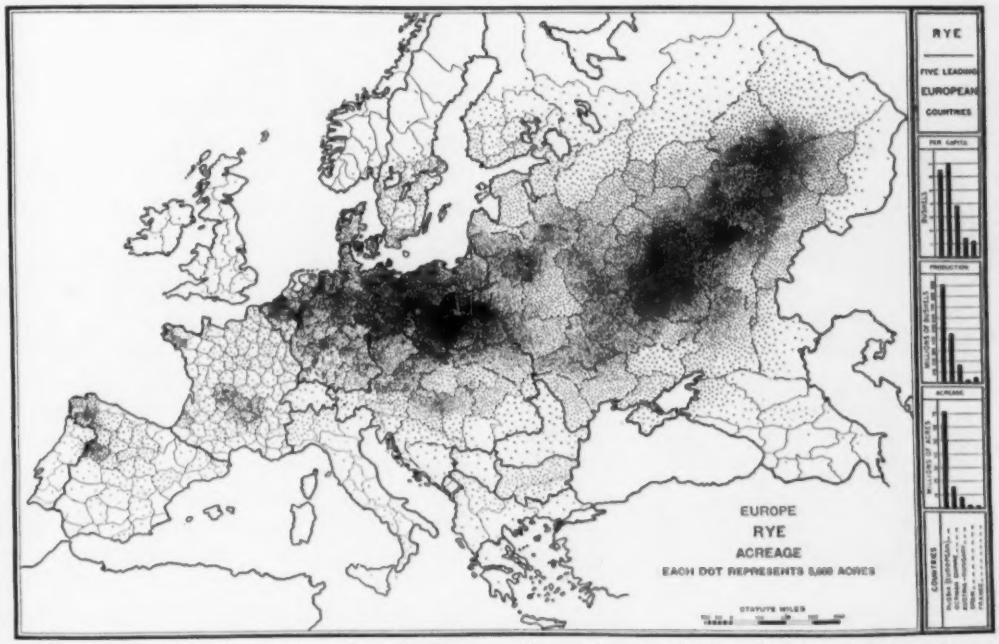

FIGURE 29.—The distribution of rye in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

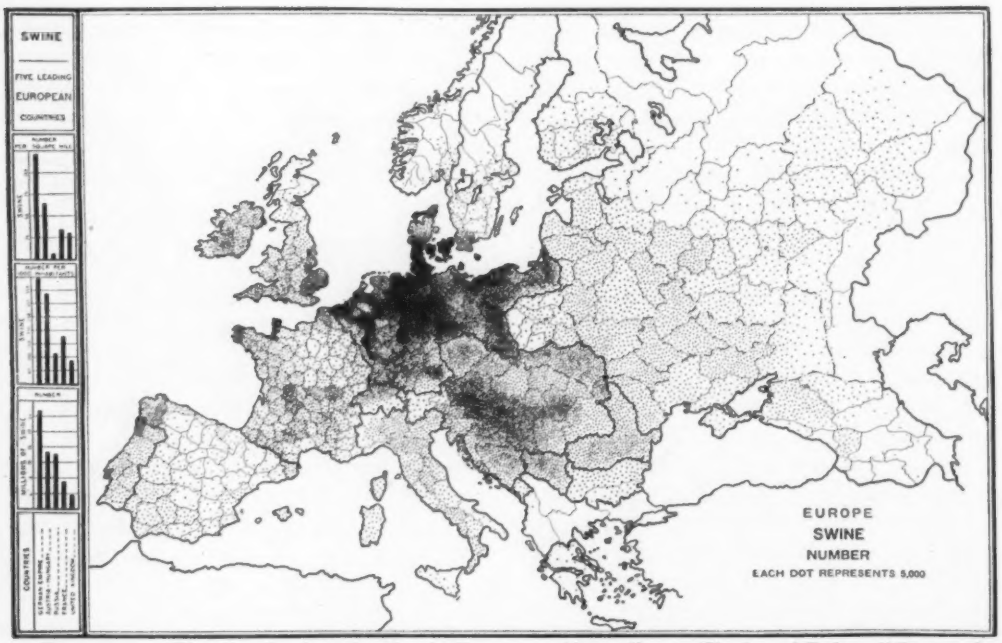

FIGURE 30.—The distribution of swine in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

duction in the industrial districts of western Poland, a correspondence in agreement with the differentiation herewith presented, and suggesting that the Warsaw-Lodz-Krakow conurbation from an agricultural viewpoint, actually belongs to the western Europe industrial district.

Corroboratively, the sandy, heath-grown Masuren land in East Prussia, despite its far Eastern location, is so important in its production of rye, oats, and potatoes that it must likewise be similarly included with the industrial district; and this importance of rye, oats, and potato production continues northward along the Baltic coast even to Libau. The production of potatoes, though locally important throughout the Baltic oats region to the north, is not so significant a factor in the food supply of northwest Europe; and so, as the demand for food increases with increased population, the Baltic states will be one of the first additions to the northwest Europe dairy region. Their soil, climate, and location are all conducive to the dairy type of agriculture, especially in Esthonia; and the people readily adapt themselves to such an intensive type of land industry.

While the marked dominance of rye in this subregion may be ascribed to the cool climate, and the glacial sandy soils of the Baltic terminal moraine, the associated importance of potatoes may not be so fully explained in a similar way; for in the Baltic states with like climate and soil, the production of potatoes is much smaller. The importance, then, of potato-growing in north Germany can only be explained by the economic factors of proximity to market and the demands of a concentrated population. The infertile sandy soil of low grade, short distance to market, and cheap water transportation by river and canal, combine to make northeast Germany peculiarly suited to the production of an exportable surplus of potatoes for human food, or for conversion into pork. Potatoes in Europe are thus somewhat comparable to corn in America (Fig. 30).

As Germany's industrial population has increased, the infertile heath-lands of northern Germany, and eastern Netherlands and Belgium, which belong to this

subregion, have been redeemed and made to grow rye and potatoes; and though during the past century, great tracts of these heaths have been planted to conifers, being natural grasslands they have permitted the dominance of both forage crops and native pasture over forest, and are consequently classified as crop-pasture land.

Small Grains, Dairy, and Tree-fruits Subregion

The southern part of the great dairy region of northwest Europe, in the interior of the European peninsula and extending about the northern curve of the Alps, is a transition division to the sugar-beet and wheat subregion on the north; to the corn and wheat region southwards, naturally better suited to grain production; and to the grain regions of Russia eastward. In this respect it is similar to the wheat, wine, and fruit region of central Europe; and some grapes are grown in this subregion. Its manufacturing is very important, and includes, for instance, the greatest center of the whole peninsula, the Ruhr district. The crops and livestock characteristic of manufacturing areas, based upon dairying, are very important in this division, and upon them depend the limits to the south and east. Wheat and rye continue important, and oats and two-row barley are so nearly of equal importance that in places it is very difficult to determine which of these four small grains is the most significant. This equal importance of the four small grains is characteristic for the whole subregion and is the only notable example of its kind in the world.

FIGURE 31.—Making hay in the coniferous highlands of Bavaria. (Courtesy of the Keystone View Co.)

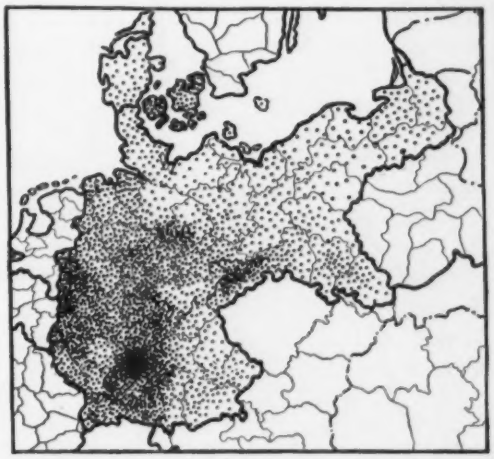

FIGURE 32.—The distribution of apple trees in Germany and Denmark. Each dot represents 25,000 trees. (From Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

FIGURE 33.—Gathering the luscious grapes from the terraced slope vineyards along a tributary to the Rhine at Rudesheim. (Courtesy of the Keystone View Co.)

Dairying is also characteristic. Being a transition section in regard to the sugar-beet and wheat subregion, sugar-beets are important locally and, as usual, found on the best soils.

The surface of this region is rugged, and includes such contrasted relief as the forested highlands of the Black Forest, of the Vosges, and of the Bohemian highland, and the highly improved farm lands of the Bavarian High Plateau, the Swiss High Plateau, the Bohemian and Moravian-Austrian plains of the Bohemian Basin, and the deeply trenched valleys of the Rhine and the Moselle. The climate and the soils resemble those of the sugar-beet and wheat region, but are more variable as a consequence of the varied relief. The forested highlands have heavier rainfall, lower temperature, and lighter soil, whereas the plateaus and plains have less rainfall, higher temperature—at least in summer,—and a dark-colored silty loam soil, not so deep, not so fertile, as the soil of the sugar-beet sections (Figs. 31, 32, 33, and 34).

FIGURE 34.—Forested ridges and intensively cropped plains alternate across the small grains, dairy, and tree-fruits subregion. The fields are small, the farmsteads neat and comfortable. (From "Geographie Hundertjahr Ausgabe.")

CENTRAL WHEAT, WINE AND FRUITS REGION

This region is located north of the Mediterranean zone, with which it has some features in common. The grape for instance, is grown throughout the whole region and in general its northern limit coincides with the northern limit of the region. Exception must be made of grape-growing areas in the river basins of the southern portions of the small grains, dairy, and fruits subregion, particularly along the Rhine and the Moselle, where the agriculture, before the great development of manufacturing, was very similar to that of this region. Dairying, and its associated crops are, however, not unimportant in this region, especially in the western portion (Fig. 35).

The region is physiographically varied. It includes the four great central European major mountain ranges, young in age and topography,—the Pyrenees, the Alps, the Carpathians and the Caucasus,—as a separate subregion. The remainder, the central European hilly uplands subregion of greater age and more mature dissection has also a rough topography, but other features give it, insofar as its agriculture is concerned, a distinct character.

Hilly Uplands Subregion

The Hilly Uplands subregion which constitutes the more important agricultural part of the main region, extends from the Bay of Biscay to the Caspian Sea, but its principal portions are located in France, in the northern Balkans, and in the Caucasus. Although wheat and the grape and other fruits are grown intensively only in some parts of the subregion, these crops are grown generally over the whole section, and thus give to the district its agricultural characteristics. Because of the variations in its economic organization, as well as

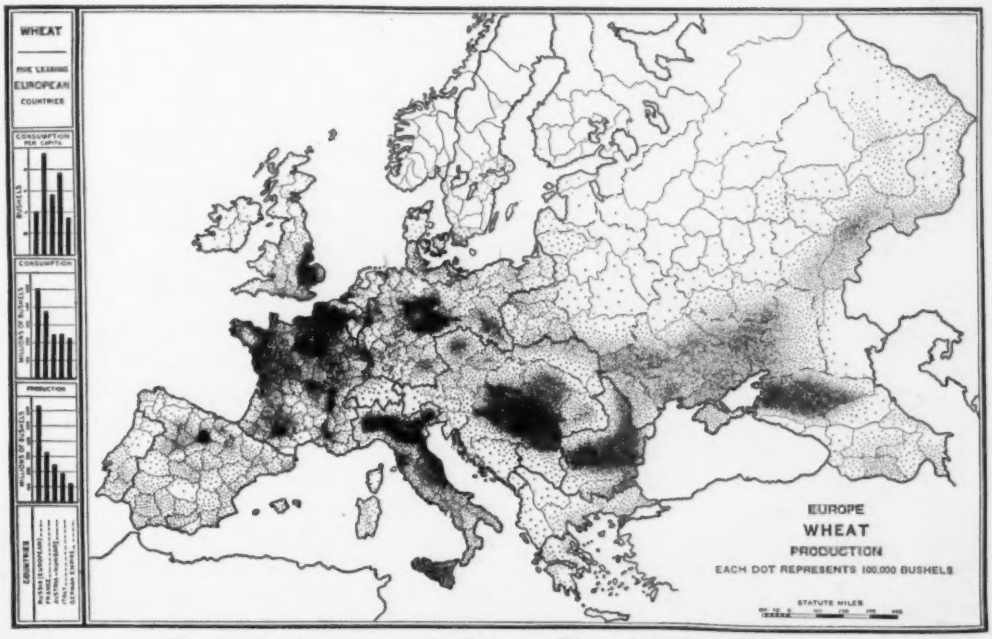

FIGURE 35.—The distribution of wheat in Europe. Throughout the whole central wheat, wine, and fruits region, almost coincident with the winter wheat province, wheat is the most important grain crop. Along its northern border in the sugar-beet, wheat, and dairy subregion, and along its southern border in the corn and wheat region, wheat is relatively less important though actually produced in greater quantity. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

in the physical conditions, the agriculture varies more than in any other section of Europe. Particularly is this true for the portion in France, which nevertheless is one of the most important wine and grain (especially wheat) producing areas in all Europe (Fig. 37).

This importance follows from three conditions: (1) the rather favorable climatic situation, a transition position between the maritime conditions produced by the winds from off the ocean to the north and those by the winter rains at the south; (2) the section contains alluvial filled basins which radiate from the "Massif Central"; and finally, (3) the very high protective tariffs. Wheat is most important except upon the more infertile soils like those of the sandy areas of the Landes; the rough terrane of the "Massif Central" and the Cevennes; and upon such dry chalk plateaus as the "Sologne" and the "Champagne Pouilleuse" in the Dry Champagne; in all of these areas rye is more important than wheat. Millet is found in the improved portions of the Biscay dune area, on the dry areas overlying glacial deposits of the upper Rhone-Saone basin, and on the Dombes

FIGURE 36.—The region of transhumance near Grindewald, Switzerland. This is the permanent homestead in the valley. (Courtesy of the Keystone View Co.)

FIGURE 37.—The distribution of grapes in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

lake plateau characterized by infertile marshes with numerous ponds and interspersed barren moor-land tracts. Barley and rye are typical of the Dry Champagne. Buckwheat, grown mainly in Russia and France, is important in the Massif Central and in the Brittany-Normandy portion of the general northwest European dairy region.

Though the portion of this subregion lying east of the Alps has in general a rougher topography, more typical continental climatic conditions, less progressive population, and more isolated location, the general description of the agriculture of the subregion applies equally well. The three most characteristic crops, wheat, wine, and fruits, indicate its transitional nature with reference to the Mediterranean region.

In the north Balkan section corn is relatively of great importance and is the staple grain food of the population. This Balkan area, originally forest covered, before the war exported much lumber especially from its southwestern portion. It is now and probably will ever be largely cut-over land, and therefore has been classified as a pasture-crop area.

The easternmost portion of the subregion, consisting of Crimea north of the Yaila Mountains and the area which coincides in the main with the drainage basin of the Kuban river in the Caucasus, has the level topography and other physical characteristics of a grain region; because of its important yield of winter wheat (the most important winter wheat area in Russia) and its production, for the Russian market, of the grape and other fruits, it belongs to this subregion. This area grades almost imperceptibly outward from the mountains into the neighboring dry sections of Russia with their production of spring grains and dominant grazing.

In contrast with the dry districts of grazing and of spring wheat growing in southeastern Russia, the physical conditions of these areas are more similar to those described for the sugar-beet and winter grains region. This is indicated by the character of the soils, which change from infertile brown soils, with

alkali in the grazing lands, to a dark-colored and very productive soil resembling the chernosem of the sugar-beet sections.

Major Mountains Subregion

This region has been included as a subdivision of the wheat, wine, and fruit region, partly because of the location of the mountains in the region and partly because of the production of the same characteristic crops in some of the valleys where the conditions are most favorable. Forests and pasture are most typical for the area as a whole.

As the temperature and rainfall of mountain regions vary with different elevation, there is a corresponding change in plant life: and a vertical series of belts of vegetation upward along the mountain sides results, which is somewhat comparable with corresponding horizontal series of zones northward toward the cold desert. Each of these vegetation belts supplies something for man's use even though it may be difficult of access and utilization. The hardwood and mixed forest belts produce cereals and hay when the land is cleared; the coniferous forests supply timber, both for fuel and construction purposes, and the high alpine grasslands supply summer pasture for herds and flocks. Life in the district must be organized very care-

FIGURE 38.—Tree-fruits are an important crop in the hilly uplands on mountain valleys of the central wheat, wine, and fruits region. The Vale of Lauterbrunnen and the lovely fall of the Staubbach. (Courtesy of the Keystone View Co.)

fully to make the best possible use of the resources. In the wide U-shaped valleys more land is capable of cultivation and, therefore, the density of population is greater (Figs. 36 and 38).

Dependent upon the direction of the valleys and slopes, and the consequent variation in the amount of direct sunshine, the character of the natural vegetation as well as that of the agriculture, varies from vineyards and citrus fruit gardens to fields of barley, oats, potatoes, and hay in the coniferous forest belt. In the Alps, barley extends to a height of 2000 meters, rye to 1850 meters and wheat to 1200 meters. Primarily because the Alps are located in rather close proximity to, and between the great manufacturing district which extends into Switzerland and Austria, and the industrialized upper portion of the Po basin, the agriculture has been more highly developed, and the water-power and forest resources have been much more intensively utilized in this area than in any of the other mountainous areas of Europe.

(*Continued in January issue*)

TRADE COMMUNICATIONS IN TROPICAL AFRICA

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THE flow of trade is a circulation set up by as complex a group of factors as the circulation of the atmosphere or the oceanic waters. Its volume and regularity depend upon the restrictions or the facilities which it encounters at any or every stage. In pure geography, the great problem of Tropical Africa is the new adjustment of life and labor in these lands consequent upon the change in geographic values brought about by European and American enterprise (Fig. 1). The "dual mandate"[1] has not yet been satisfactorily and justly worked out and calls for sound and sympathetic inquiry in many fields of human and economic studies. Tropical Africa constitutes one of nature's vast hot houses, potentially as rich in agriculture as any of the equatorial and adjacent lands.[2] Evidences are not lacking of abundant mineral wealth in gold, copper, tin, and other metalliferous ores. An approximate estimate of population[3] indicates also the possibility of abundant African labor if it can be obtained consistently with the cultural development of the African and without violating the principles which public opinion on both sides of the Atlantic is steadily insisting should govern the administration of backward peoples. Both the physical and the human concomitants of African development present great problems, but these, though prime factors in the circulation of trade, form but the background of the present inquiry—the development of communications.

[1] For a scholarly treatment of the question, see *The Dual Mandate in British Tropical Africa*, Sir F. D. Lugard, Blackwood, 1924.

[2] The Imperial Institute Series of Handbooks to the Commercial Resources of the Tropics, especially *The Agricultural and Forest Products of British West Africa*, G. C. Dudgeon, Murray, 1922.

[3] See Table I.

The Modern Trade Era

In British Africa, the modern trade era may be said to have been initiated by three chartered companies. The Royal Niger Company opened up the lands of the lower Niger and Benue rivers; the Imperial British East Africa Company operating from a base in the Arabic Sultanate of Zanzibar, penetrated into the highlands of what are now Kenya and Uganda; north of the British and Dutch States of South Africa, the Royal African Chartered Company administered and opened up the lands extending up to and beyond the Zambezi River, squeezing northwards between Mozambique and Belgian Congo.

In each case, administrative authority passed sooner or later from the company to the crown, whilst considerable additions have been made both by Britain and by France in the "scramble" which took place from the '80's onwards and the reapportionment of territory following the war (1914–1918). Economic development, in so far as it is dependent on public utilities, is, or may be, a matter of political policy. In the British colonies, it may be even a local colonial policy, and the development of the Gold Coast bears little or no relationship to that of Sierra Leone and Nigeria. This arises largely from their isolated character. Until 1912 Southern and Northern Nigeria formed two (and formerly three) political organizations differing geographically from each other to a considerable degree. Slowly, however, the river and railway systems formed a framework which united the two Nigerias for trade purposes and made Lagos and the Bight of Benin their gateway to the world. A position somewhat comparable has developed in the highland

TABLE I

FRENCH WEST AFRICA

(Dakar—Capital and residence of Governor-General)

Colony	*Admin. Centre or Capital*	*Area* (*sq. mls.*)	*Pop. 1921* *White*	*African*
Senegal	St. Louis	74,112	5,287	1,220,236
Mauritania	St. Louis	154,200	214	261,532
Guinea	Konakry	89,436	1,386	1,874,565
Ivory Coast	Bingerville	121,590	835	1,544,845
Dahomey	Porto Novo	41,302	538	841,705
Sudan	Bamako	356,471	983	2,473,606
Upper Volta	Wagadugu	142,820	191	2,973,251
Niger	Zinder	404,914	216	1,083,826
	Total	1,384,845	9,650 (French 7,742)	12,273,566
Togo (Fr.)	Lomé	22,000	213	698,127

FRENCH EQUATORIAL AFRICA

(Brazzaville—Capital and residence of Governor-General)

Gabun	Libreville	121,862	623	388,778
Middle Congo	Brazzaville	150,292	769	581,143
Ubangi-Shari	Bangui	208,219	261	607,644
Chad	Fort Lamy	501,676	279	1,271,371
	Total	982,049	1,932	2,847,936
Cameroons (Fr.)	Yaoundé	166,489	741	2,540,000
	Grand French Total	2,555,000	12,500	18,360,000

BRITISH WEST AFRICA

Gambia	Bathurst	4,134	205*	209,000
Sierra Leone	Freetown	31,000	1,161*	1,541,311
Gold Coast	Accra	80,000	2,165	2,078,043
Nigeria	Lagos	335,700	3,900	18,070,608
	Total	450,834	7,431	21,898,962
Togo (Br.)		12,600	15	188,265
Cameroons (Br.)		31,000		550,000

BRITISH EAST AFRICA

Zanzibar (with Pemba)	Zanzibar	1,020	270	216,790 [1]
Kenya	Nairobi	212,000	9,651	2,360,000 [2]
Uganda	Entebbe	110,300	1,289	3,119,645 [3]
	Total	323,320	11,210	5,696,435
Tanganyika Territory	Dar-es-Salaam	365,000	2,447	4,107,000 [4]
Nyasaland	Zomba	37,890	1,421	1,173,808 [5]
N. Rhodesia	Livingstone	291,000	3,750	1,000,000
	Grand British Total	1,468,000	26,259	33,876,000
Belgian Congo	Leopoldville	909,654	10,037	8,500,000
Angola	Loanda	484,800	12,000	4,119,000
Mozambique	Lourenco Marques	428,132	—[6]	3,120,000

*Not including Protectorates.

[1] Arabs, 10,000; Indians, 12,900.

[2] Arabs, 10,102; Indians, 22,822.

[3] Asiatic, 6,521.

[4] Asiatics, 14,991; (Indians, 9,411; Goans, 798; Arabs, 4,782).

[5] Asiatics, 613.

[6] Total white population not known. The number of Europeans in the ports: Lourenco Marques, 4,691; Beira, 738; Mozambique, 472; Chinde, 218; Inhambane, 100.

regions of Kenya, Uganda and Tanganyika Territory adjacent to each other, which have the harbors of Kilindini, Tanga and to some extent Dar-es-Salaam as their outlets. The question of some form of economic, if not political union

is under discussion; already the three have a common customs tariff, and the Uganda Railway which serves both Kenya and Uganda is operated under an organization independent of the two political administrations.

In French West Africa and French Equatorial Africa a greater conception of unity prevails and in some measure the development of communications is directly related to the strengthening of that unity. Whilst, therefore, in French Africa a general policy for the whole shapes in great measure the policy of the parts, and commercial interests are regarded as being served by the large political policy, in the British Colonies private enterprise is a much more insistent factor in the policies of the several colonies.[4]

WEST AFRICA

The simplest statement of the physical conditions of West Africa is that of a discontinuous plateau extending from the Futa-Jallon in the west to Bauchi and the Cameroons in the east. The seaward slopes, subjected to two wet seasons annually as the sun moves north of the Equator and back again, have natural forests, except possibly in the Gold Coast where a marked break in the annual rainfall (Accra, 30 inches) has resulted in a southward tongue of savannah. Northward, beyond the plateau, where the two rains coalesce and the total rainfall steadily diminishes, forest opens out to parkland, and parkland and savannah break down to grasslands which pass in easy stages to the arid and semi-arid conditions of the Sahara.[5] This dual division, marked physically by the irregular divide of plateaus coincides broadly with a marked cultural division. On the south, the negroes dwelling in forest villages cultivate or gather maize, rice, yams, cassava, plantain and banana and other fruits for food. To the north, mixed races, often Muhammadan in religion, add to the cultivation of millet, groundnuts and similar crops, the pasturing of flocks and herds. Here also, large walled towns as Timbuktu, Kano and Katsina form centers of arts and crafts as well as culture, of which the south has no counterpart, except possibly in the southwest of Nigeria in Yorubaland.

The British possessions, with the exception of Gambia, lie principally in the forest belt, though the northeast of Sierra Leone (Fig. 2), the Northern Territories of the Gold Coast, and especially the Northern Province of Nigeria penetrate landwards to the open pastoral country. French territory may be said to have its West African base in the Sudanese grasslands, with a natural artery of the Senegal and Middle Niger, and an artificial one in the Dakar-Kayes-Bamako railway. To the southward, French possessions extend to French Guinea, Ivory Coast, Togo and Dahomey. In British West Africa, the links with Britain are by sea, and the sea is the only possible link between the four colonies. In French West Africa, apart from the contiguity of territory which makes a single adminis-

[4] See *Private Enterprise in British Tropical Africa*, Cmd. 2016, 1924, 6d; a short Report of the Committee appointed by the Secretary of State for the Colonies to consider and report whether, and if so what, measures could be taken to encourage private enterprise in the development of the British dependencies in East and West Tropical Africa, with special reference to existing and projected schemes of transportation. A much more important and lengthy report is that of the East Africa Commission (Cmd. 2387, 1925, 3/6). Two of the terms of reference to the East Africa Committee were to consider and report:

(a) on the measures to be taken to accelerate the general economic development of the British East African Dependencies and the means of securing closer coördination of policy on such important matters as transportation, cotton-growing and the control of human, animal and plant diseases.

(b) on the steps necessary to ameliorate the social conditions of the natives of East Africa, including improvement of health and economical development.

(The following abbreviations are used: Cmd., refers to official Government documents; *G. J.*, the *Journal of the Royal Geographical Society; A. J.*, of African Society; *G. R.*, *Geographical Review*.)

[5] The climate of Africa is discussed by Knox, *The Climate of Africa* and valuable maps are contained in *The Vegetation and Soils of Africa*, Shantz and Marbut, American Geographical Society.

TABLE II

Value of Trade

FRENCH WEST AFRICA

(Unit = 1,000,000 francs)

Colony	*Imports*		*Exports*	
	1922	*1923*	*1922*	*1923*
Senegal	223.7	313.7	192.9	253.4
French Guinea	30.7	57.7	21.2	34.6
Ivory Coast	37.7	55.7	48.5	62.6
Dahomey	42.8	62.6	41.9	56.2
French Sudan	15.1	31.0	2.7	4.2
Upper Volta	1.5	12.7	4.0	8.0
Total	351.5	533.4	311.2	419.0
Fr. Equat. Af.	25.8		39.5	

Exports 1922

Fr. West Africa		*Fr. Equatorial Africa*	
Total	311.2	Total	39.5
Ground nuts	152.9	Timber	15.7
Palm kernels	37.0	Palm kernels	6.7
Palm oil	21.2	Palm oil	0.3
Timber	25.9	Ivory	6.1
Animals	5.4	Caoutchouc	1.2
Hides and skins	4.8	Cocoa	0.2

BRITISH WEST AFRICA

(Unit = £1,000)

Colony	*Imports*		*Exports*	
	1922	*1923*	*1922*	*1923*
Gambia	862	814	1,037	900 [1]
Sierra Leone	1,511	1,950	1,373	1,607 [1]
Gold Coast	7,901	8,449	8,335	8,959 [1]
Nigeria	10,907	11,762	10,451	11,705 [1]
Total	21,181	22,975	21,196	23,171

BRITISH EAST AFRICA

Zanzibar	1,894	1,943	2,028	2,280 [1]
Kenya and Uganda	2,871	4,258	2,781	3,996 [2]
Tanganyika	1,238	1,475	1,300	1,658
Nyasaland	522	462	442	425
Total	6,525	8,138	6,551	8,359
Grand total for British Tropical Africa	27,706	31,113	27,747	31,530

[1] Including specie.

[2] Kenya, Uganda and Tanganyika have a uniform Customs Tariff.

tration possible with a concerted scheme of communications, there have been from time immemorial caravan links between the Sudan and Barbary. When the automobile, the airplane, and the railcar have displaced the camel, the bridging of the Mediterranean and the Sahara will be complete and France will be one and indivisible from the Narrow Seas to the Gulf of Guinea.

In the British colonies, communications have as almost their sole objective, the opening up of the several possessions. From this standpoint Gambia may be passed over without much comment. It is little more than the banks of the navigable lower Gambia. Of the two great river ways direct from the Atlantic to the Sudan—routes which made Goree and other stations figure prominently in the trade wars of the eighteenth century—the Gambia is more important than the Senegal. The seasonal unnavigability of the Senegal in spite of dredging and construc-

FIGURE 1.—Freetown, Sierra Leone, capital in both political and economic fact. It is a busy, prosperous city, indicative of the future growth and influence of the African seaboard cities as their hinterlands are developed. (Courtesy of the Visual Instruction Committee, Great Britain. Photo by Lisk-Carew Bros., Freetown, Sierra Leone.)

tive work is now counterbalanced by the completion of the Dakar-Kayes Railway. The Gambia with its commodious harbor of Bathurst may yet be the outlet of a very prosperous French Sudan. As it is, French Africans come annually to the Gambia, cultivate groundnuts and, after marketing their produce, return to Senegal.[6]

SIERRA LEONE

Sierra Leone, 5 degrees south of Gambia and only $8\frac{1}{2}$ degrees north of the Equator, feels the full effects of the southwesterly winds (Fig. 3). Rain falls abundantly on the Sierra Leone spurs of the Futa Jallon and on the hills which extend across the plain westward from the main highland mass. The Sierra Leone mountains rise 2,000–3,000 feet, forming a forested background to the port of Freetown and a residential hill station for the Europeans whose business is located in Freetown. The change in general direction of the rivers coincides with the beginnings of the plain. Toward the coast, swamps and deltaic formations appear, terminating in the low lands of Sherbro Island and Turner's Peninsula. The whole of this region is forest clad, though the virgin forest has long been destroyed by the wasteful methods of clearing adopted by the African. Forest conservation, especially for gum copal, and afforestation have now been taken in hand. The trees of greatest present value are the oil palm and

[6] The value of Gambia for trade purposes is indicated by its imports and the cession of Yarbatenda to France. In 1923, the value of the imports was £899,509 and included cotton piece goods £232,770, Kola nuts (from Sierra Leone and other West African regions) £104,704, rice £70,117. Under the Anglo-French Convention of 1904, the river port of Yarbatenda with all its landing places was ceded to France, and if this port should prove inaccessible to sea-going merchantmen, access to the river will be granted to France at an accessible point lower down.

FIGURE 2.—The Moa River bridge in the Sierra Leone Protectorate, the river at flood. Heavy initial outlay is necessary to the operation of the African railways. (Courtesy of the Visual Instruction Committee, Great Britain. Photo by Lisk-Carew Bros., Freetown, Sierra Leone.)

kola. The railway crosses the oil palm belt, the main line and the northern branch from Boia Junction embracing as it were the palm clad foothills (Fig. 4). Motor roads follow the valleys and act as feeders, thus ensuring that almost the whole of the trade of Sierra Leone passes through Freetown. The lower river courses, and the coastal waters act as local means of communication and a certain amount of local trade passes through Bonthe and Sulima in the south and Port Lokko in the north.

The port facilities of Freetown are not due solely to the economic development of the colony. It has an important position on or near the great Atlantic seaways and is in consequence both an important coaling station and an Imperial Admirality base. Freetown and Sierra Leone become in common parlance much more synonymous than is the case with any other capital and colony.

THE GOLD COAST

The Gold Coast [7] (Fig. 5) differs from Sierra Leone in many important respects, principally in the character of its relief and the amount of seasonal and annual rainfall. A comparatively dry north-south belt extends across the main northwest-southeast divide from beyond Coomassie to a region east of the Volta mouth. The dissected plateau country, south and southwest of the divide, roughly triangular in shape, has a natural covering of equatorial light rain forest, though evidences are not lacking of a steady encroachment of the savannah round the east along the southern coast.[8] The gold bearing rocks, of which the dis-

[7] See author's article "The Gold Coast Colony and Protectorate," *Journal of Manchester Geographic Society*, Vol. XXXVIII, 1922.

[8] A valuable discussion of the climate and vegetation of the Gold Coast is *The Forest Officer's Handbook of the Gold Coast*, T. F. Chipp. The Crown Agents for the Colonies.

FIGURE 3.—Sierra Leone, a land of varied relief, climate and resources, has a well developed system of rail and motor communication, radiating from Freetown, its capital, an important port on the great Atlantic seaways.

integration yielded the river deposits from which the colony obtained its name, have long been worked about the mining towns along the railway from Seccondee to Coomassie (Fig. 6). The villages of the eastern forest lands forming the hinterland of Accra, at the opening of the twentieth century took up the cultivation of cocoa. The industry has spread westward over the dissected plateau and has determined largely the general framework of communications. The new railway from Accra to Coomassie opens up the cocoa country, while the network of motor roads along the coastal foothills not only gives an auxiliary route to the sea from the western to the eastern province, but taps the southern forest villages for cocoa and oil palm products, linking them with one of the ports. Along this savannah coastal strip plantations of coconuts and sisal have recently been

FIGURE 4.—The cattle industry at Grafton, Sierra Leone, already important is but an earnest of the future possibilities of the region, both savannah and foothills. (Courtesy of J. T. Furley.)

established and promise great possibilities.

Beyond the "divide" the river plains of the Middle Volta have at present but a scanty population. Still farther north on the low plateaus of the Northern Territories stock raising and the cultivation of millet and groundnuts form native occupations which the agricultural department is fostering and developing. This is the region of the sheanut tree of which the oil (or butter) serves the northern peoples for cooking purposes, as the oil palm does those of the south.

Motor roads running parallel with the Anglo-French boundary link these areas together (Fig. 7), whilst the main route to the south is the motor road through Tamale, and across the Yeji ferry to the railway junction of Coomassie. The movement of traffic over these northern lands is closely connected with the similar lands north of the frontier. Thus cattle move south from French territory by way of the veterinary stations of Navoro and Lorha to Coomassie and the large mining towns and villages. Similarly a certain amount of traffic, especially in salt and kola, passes north.

Geological surveys carried on during and since the war have shown that large deposits of manganese and bauxite exist. The export of the manganese ores and the further development agriculturally of the forest zone have raised in an acute form the question of a deep-water harbor. Hitherto, Seccondee and Accra, the principal ports, have depended upon lighters and surf boats working between jetties, protected from the surf by breakwaters, and the ocean vessels anchored a mile or two from shore. Works are now in progress for the construction of a deep-water harbor at Takoradi capable of handling at wharves the mining machinery for gold, manganese and other ores and shipping in bulk such commodities as manganese. The new line to Kadde cuts through the triangle and taps new timber (mahogany) and cocoa country.

NIGERIA

In Nigeria (Fig. 8) the Y-shaped framework of water communications has had superimposed on it an inverted Y of railways, the latter crossing the former at the Jebba (Niger) and Makurdi (Benue) bridges. In this way the compact four-

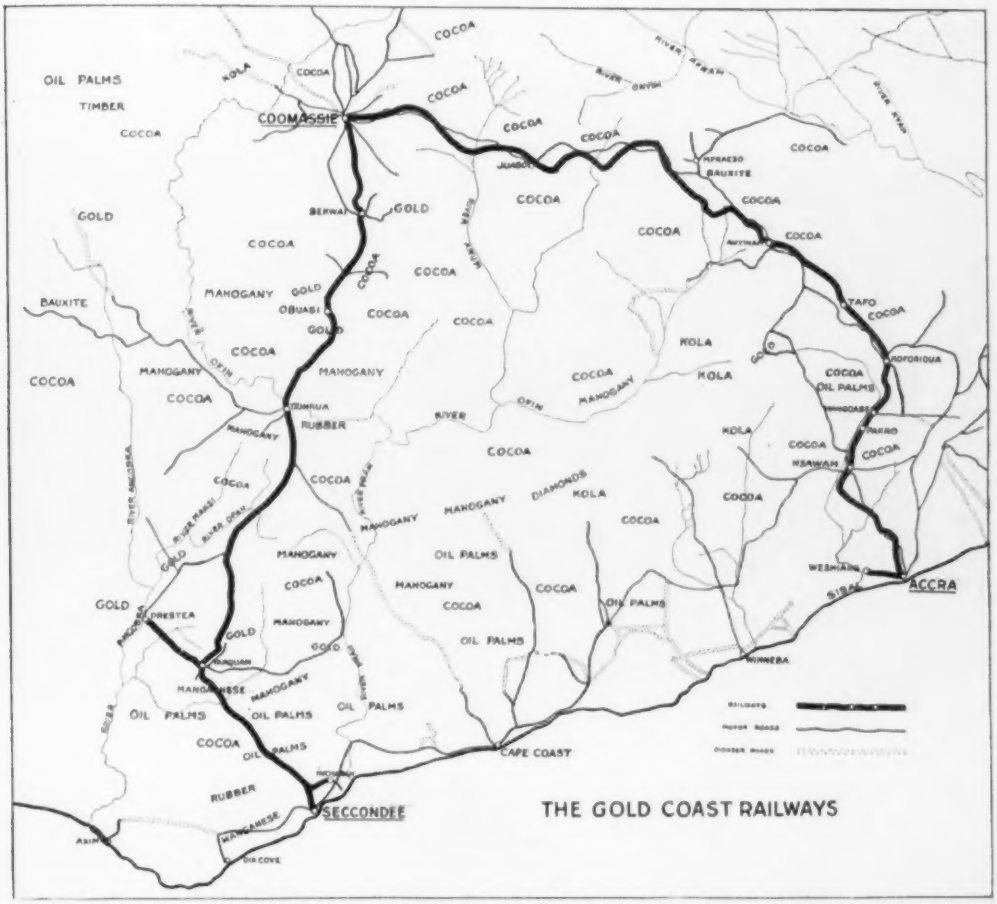


FIGURE 5.—Gold Coast and South Ashanti are very densely populated and highly developed. The Gold Coast territory is served by two main rail lines from Seccondee and Accra to Coomassie and a connecting network of motor roads that have opened up the entire country to development.

square colony of 335,700 square miles has a ground plan of communications tapping several regions of production, and capable of expansion with economic development. The deltaic regions of the Niger and Cross rivers—the 'Oil Rivers' of the early traders—still yield the greatest export of oil palm products and timber, principally mahogany. A new development is in progress with the opening of the Enugu (Udi) coalfield and the construction of Port Harcourt at the terminus of the eastern railway. The Bauchi plateau rich in alluvial tin deposits, has hitherto been but inadequately connected with Lagos by branch lines from the main Lagos-Kano railway. The construction of the Eastern Railway now in progress, will not only link it with the coal of Enugu, but will give it a port of direct communication with the outer world (Fig. 9). The Western Railway falls into two fairly well marked sections. From Lagos (Ebute Metta) to Jebba, the railway and its feeder motor roads traverse country occupied by some of the most progressive negro peoples. Apart from the cultivation of native food supplies on a rather more scientific basis than is found elsewhere among the negroes, there has been of recent years considerable development in cocoa, cotton and other forms of tropical agriculture.

Beyond the Jebba Bridge, the main railway with the Baro extension traverses country more akin geographically

FIGURE 6.—Coomassie, "lovely village of the Golden plain," is an inland centre of influence and industry of the Gold Coast: Railways have made the city a pioneer metropolis. (Courtesy of the Visual Instruction Committee. Great Britain.)

FIGURE 7.—A native village in the cocoa lands of the Gold Coast. The motor truck is the modern link between such villages as this and the railways to the sea.

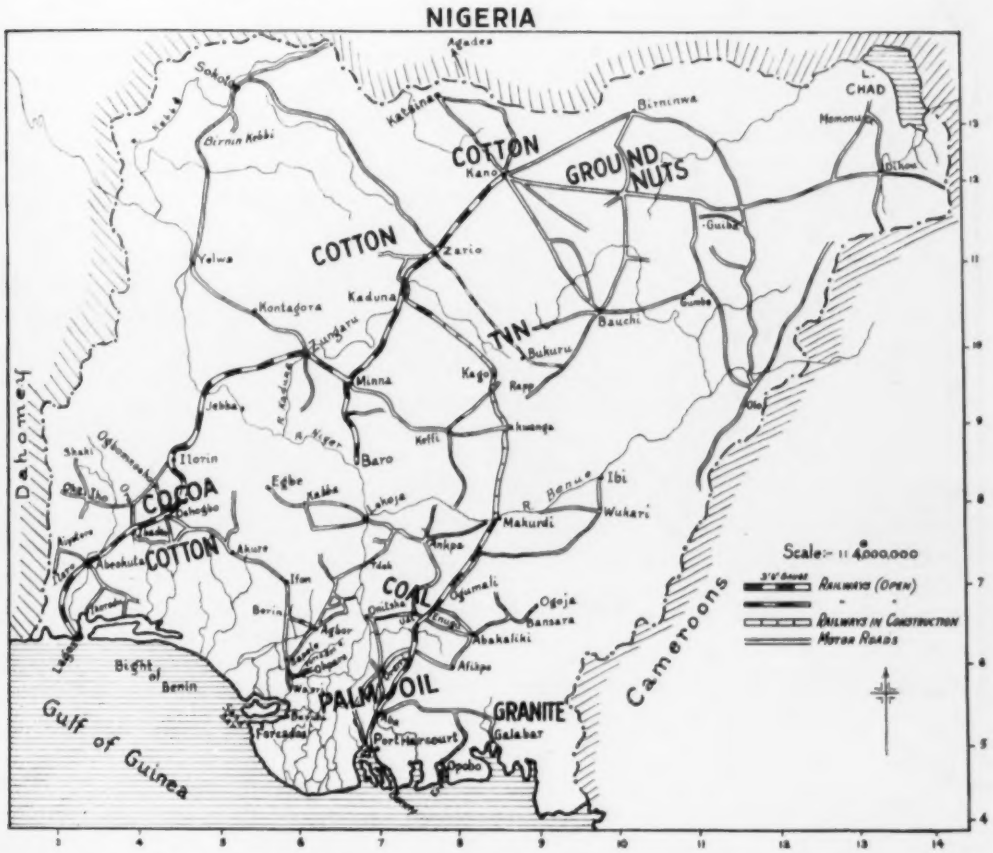


FIGURE 8.—In Nigeria, the Y-shaped framework of water communications, and the superimposed inverted Y of the railways tap the several regions of production and form the basis for a more complete system for the exploitation of the varied and extensive mineral deposits, as well as for the agricultural resources.

to the Sudan than to the Guinea forest belt. It is the land of Muhammadan emirates and sultanates, of densely populated cities and extensive pastoral pursuits (Fig. 10). Life is much more organized and the arts and crafts much more developed. Irrigation of a more or less simple type has long been in practice and European administration has only fostered and developed the forms of stock-raising and cultivation already in existence. From the Niger to the shores of Lake Chad coöperative cultivation by irrigation is extending and the output of cotton is expected to increase considerably.

FRENCH WEST AFRICA

The development of French West Africa may in general be compared with the corresponding regions of the British colonies. In French Guinea, Ivory Coast, Togo and Dahomey the possibilities and present attainments are essentially those of Sierra Leone, the Gold Coast and Nigeria. In the Sudan, France has the problems of the Northern Province of Nigeria spread over a vaster area. The region of the Middle Niger with Lakes Fagibini and Horo may possibly yield considerable quantities of cotton by irrigation. Elsewhere stock-raising (Fig. 11), especially on the pastoral lands of the upper Niger and Senegal, offers such possibilities in cattle products—hides, skins, extracts and perhaps ultimately frozen meat—as warrants the putting down of plant at Bamako and Kaolakh.

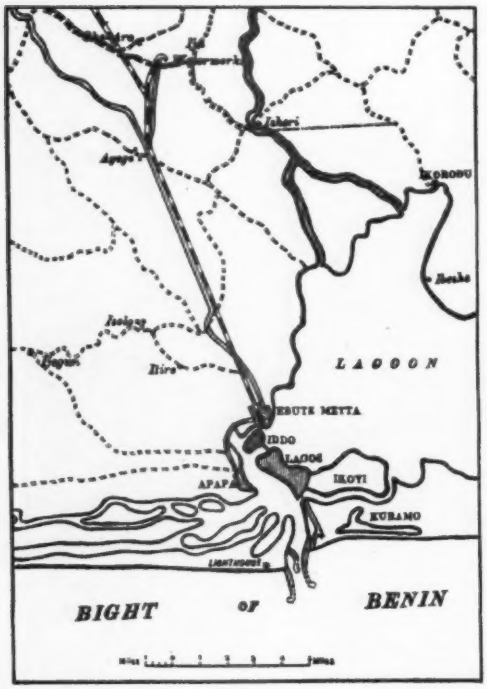


FIGURE 9.—Lagos, at the terminus of the Western Railway, is the natural outlet for the produce of a hinterland occupied by most progressive negro peoples, and farther from the sea by densely populated Muhammedan emirates and sultanates, highly organized in the arts and crafts. (Map taken from Nigeria Handbook p. 173.)

The whole agricultural and pastoral development of West Africa hangs upon an accurate interpretation of the apparently increasing desiccation of the entire region, an interpretation which will make for a solution, wholly or in part, of the problem. The major question of the progressive desiccation of the Sahara is of course fundamental, and viewed over millennia, is unquestioned; but the nature of the fluctuations within the larger movement is not yet determined. Some claim that the cause is physical, that is, actually a diminishing rainfall only to be checked, if checked at all, by conservation of the water directly by reconstructing old lakes drained as the result of river capture,[9] and indirectly by a policy of reforestation and forest conservation. Others urge the rapid encroachment of the Sahara on oases and Sudanese grasslands as due to lawlessness and warfare, and at best hindering development through lack of security.[10] That this has been a part cause of the decline of the Sudan there is no question, the Moorish conquest wiping out great empires with university cities and centers of great learning.[11] It has been claimed too, that the wasteful methods of forest clearing by fire, and the destructive propensities of goats in eating off young seedlings, have brought about conditions which have allowed the savannah to encroach on the forest, possibly affecting in some measure the amount of rainfall.

It is natural to suppose that the total result arises from all these causes in varying degrees and that some at least are removable. Apart from the general question of economic development, it affects too the communications policy of France, for routes which can serve the needs both of peace and war have greater prospects of accomplishment than those which serve the needs of one only. The Dakar-Kayes-Bamako line with the navigable middle Niger makes a west-east route of great political importance. The railways from Konakry, Ibidjan and Kotonu working from the coast lands may now be conceived in a West African scheme with Wagadugu as an important nodal point in the whole system (Fig. 12). North of the Sahara, the penetration of France into Algeria, Tunis, and Morocco has been accompanied by economic developments of first importance. It may be regarded as the obvious corollary, that more thorough exploration of the Sahara would result, with the object of linking the Barbary States with West Africa. Automobiles have crossed the desert, airplanes have made extensive surveys and trans-Saharan railway schemes have passed from the unthinkable to the highly

[9] Schwarz, "The Control of Climate by Lakes," *G. T.*, March, 1921.

[10] An excellent summary of French and British literature on the desiccation of the Sahara is given in *A. J.*, April and July, 1921.

[11] A useful survey of past cultural conditions in the Sudan is given by "*A Tropical Dependency*," F. L. Shaw (Lady Lugard), Nisbet, 1905.

FIGURE 10.—Ox transportation in Bornu, Northeastern Nigeria, a sure, but very slow, means of getting produce to market, still the only method of transportation in the remoter regions of Africa.

probable.[12] Moreover, the consolidation of French Equatorial Africa by the annexation of the Cameroons as mandate territory raises a larger question of African transport as it affects the position of France in Africa. Though at present West and East Africa, even where large policies are being considered, have little or nothing in common, yet the time must quickly come when the communications of Africa on a continental basis must be considered. This would then convert French Equatorial Africa from an intermediate region to a nodal zone. Physio-

FIGURE 11.—Cattle in the Sudan. Stock-raising especially on the grasslands of the upper Niger and Senegal, offer such possibilities in cattle products that Bamako and Kaolakh are likely to become centers of meat-packing industry in the not distant future. (Courtesy of Visual Instruction Committee, Great Britain.)

[12] *L'Afrique Française*, April, 1924. Gautier, "The Trans-Sahara Railway," *G. R.*, Jan., 1925.

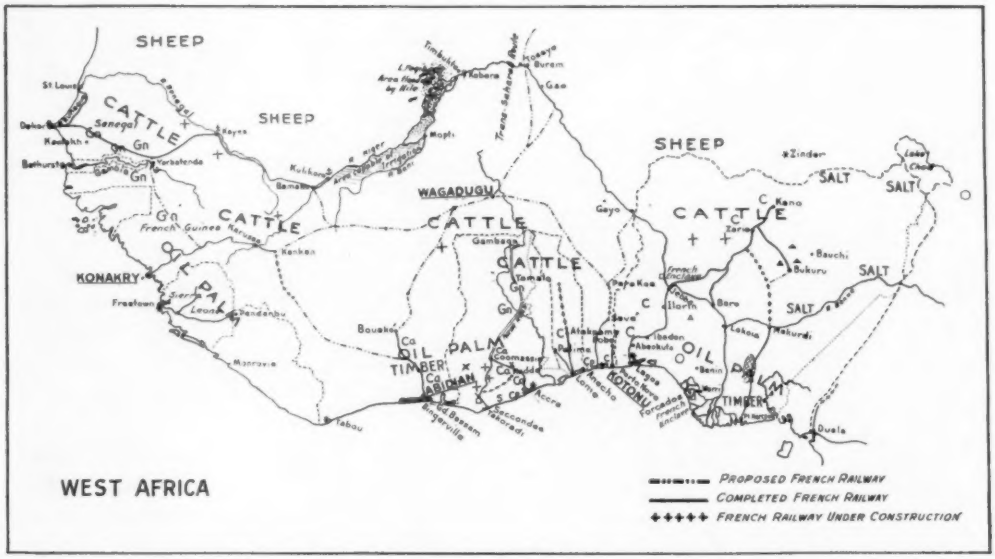


FIGURE 12.—West Africa. When the French shall have completed their railways from Konakry, Ibidjan and Kotonu with Wagadugu, as an important nodal point, their system will constitute a complete consolidation of their colonies in this region.

graphically, the central region is the Congo Basin (politically Belgian Congo), with its extremely narrow corridor to the ocean between French and Portuguese territory. This corridor contains the great outlet of the Congo River system,

FIGURE 13.—The Uganda Railway. As the fertile tropical plateaus are opened up for development their potential resources are recognized as surpassing even the dreams of the explorers. Storehouses of mineral wealth are being discovered; prospective fields of food and textile-crops are being laid out; and water power illimitable is being surveyed. (Courtesy of the Visual Instruction Committee, Great Britain.)

TABLE III

Value of trade commodities (exports)

FRENCH TROPICAL AFRICA

(Number in brackets gives the value of exports. Unit = 1,000,000 francs.)

Senegal, 1922—Ground nuts (151), hides, skins, rubber, gums.
French Guinea—Ground nuts, oil palm products, cattle, hides, rubber, wool, wax.
Ivory Coast, 1923—Mahogany (27.7), palm kernels (9.7), palm oil (9.9), cocoa 3,600 tons (8.3), cotton (0.7), rubber (0.5).
Dahomey, 1922—Palm kernels 34,726 tons, palm oil 11,645 tons.
French Sudan—Ground nuts, cattle, skins, wool, kapok, rubber, gum.
Togo (Fr.) 1923—Considerable plantations of oil and coco palms, coffee, cocoa, kola; cocoa 3,324 tons, cotton 766 tons.
French Equatorial Africa—Resources quite undeveloped.

BRITISH WEST AFRICA (1923)

(Number in brackets gives value of exports. Unit = £1,000).

Gambia—Ground nuts (870), palm kernels (7).
Sierra Leone—Palm kernels 59,545 tons (969), palm oil 3,346 tons (103), kola nuts 2,544 tons (187), ginger 1,395 tons (46), piassava 1,620 tons (20).
Gold Coast—Cocoa 442,767,348 lbs. (6,567), gold 224,638 oz. (851), manganese 135,603 tons (327), kola nuts 13,657,318 lbs. (320), mahogany 1,666,034 cu. ft. (156), palm kernels 3,757 tons (57), palm oil 358,374 galls. (38), copra 1,660 tons (37).
Nigeria—Palm kernels (3,741), palm oil (2,983), tin ore (1,190), cocoa (922), hides and skins (566), ground nuts (403).

BRITISH EAST AFRICA (1923)

Zanzibar—Cloves 201,000 cwts., clove stems 52,000 cwts., copra 185,000 cwts.
Kenya and Uganda—(U. = Uganda) Cotton (2,094; U. 2,027), coffee (621; U. 108), fibres (261), maize (249), hides and skins (153; U. 43), carbonate of soda (143), ivory, chillies, ground nuts, copra, rubber.
Tanganyika—Sisal 12,845 centals (367), ground nuts 16,508 cwts. (264), coffee 80,937 tons (205), cotton 32,912 cwts. (177), copra 6,669 cwts. (132), hides and skins 41,370 tons (118), grains 235,723 tons (94), simsim 4,435 tons (76), beeswax 6,039 tons (25).
Nyasaland—Tobacco (258), cotton (86), tea (40).

but on account of rapids, man has come to the aid of nature by the construction of a railway from Matadi to Leopoldville. The French and Portuguese railways from Duala, Pointe Noire, Loanda, Lobito Bay, and Mossamedes may be compared with these which run from the North Guinea coast inland. Their ultimate importance can only be appreciated after reference has been made to East Africa.

EAST AFRICA

Communications in East Africa have at least this advantage that they have the Cape-Cairo slogan, which imparts a sense of sentimental unity, even if at present it has little basis in fact.[13] Indeed an entirely wrong perspective will be adopted if such a conception becomes the starting point. It is true that ultimately four main projects may coalesce and bring about the dream of Cecil Rhodes. The two cities which hyphenated give the slogan, form termini for a northward movement from the Cape through British territory, and for a southward movement from Cairo along the valley of the Nile.

KENYA, UGANDA, AND TANGANYIKA

The development between these two has not been to forge a link to unite the widely separated railheads. Development has been rather to open up East Africa and link it with the Indian Ocean. In the present stage of development East Africa from an economic standpoint falls into two major regions in spite of its one Portuguese and six British political divisions. The northern area consists primarily of the plateau country some 5,000 feet in altitude (Fig 13), a plateau the peripheral lands of which are crowned by the massive mountain lands of Kilimanjaro, Kenya, Elgon and Ruwenzori, whilst Lake Victoria, Kioga and Salisbury occupy relatively low lands marked elsewhere by swamps and alluvial plains. The approach of this plateau to within a comparatively short distance of the coast, due partly to eastward extension of the plateau and partly to the westward indentation of the Indian Ocean, coincides with the group of coral islands of which Zanzibar and Pem-

[13] A voluminous work (4 vols.), *The Story of the Cape to Cairo Railway and River Route*, has appeared, of which the map volume is the most important. The Pioneer Publishing Co., London.

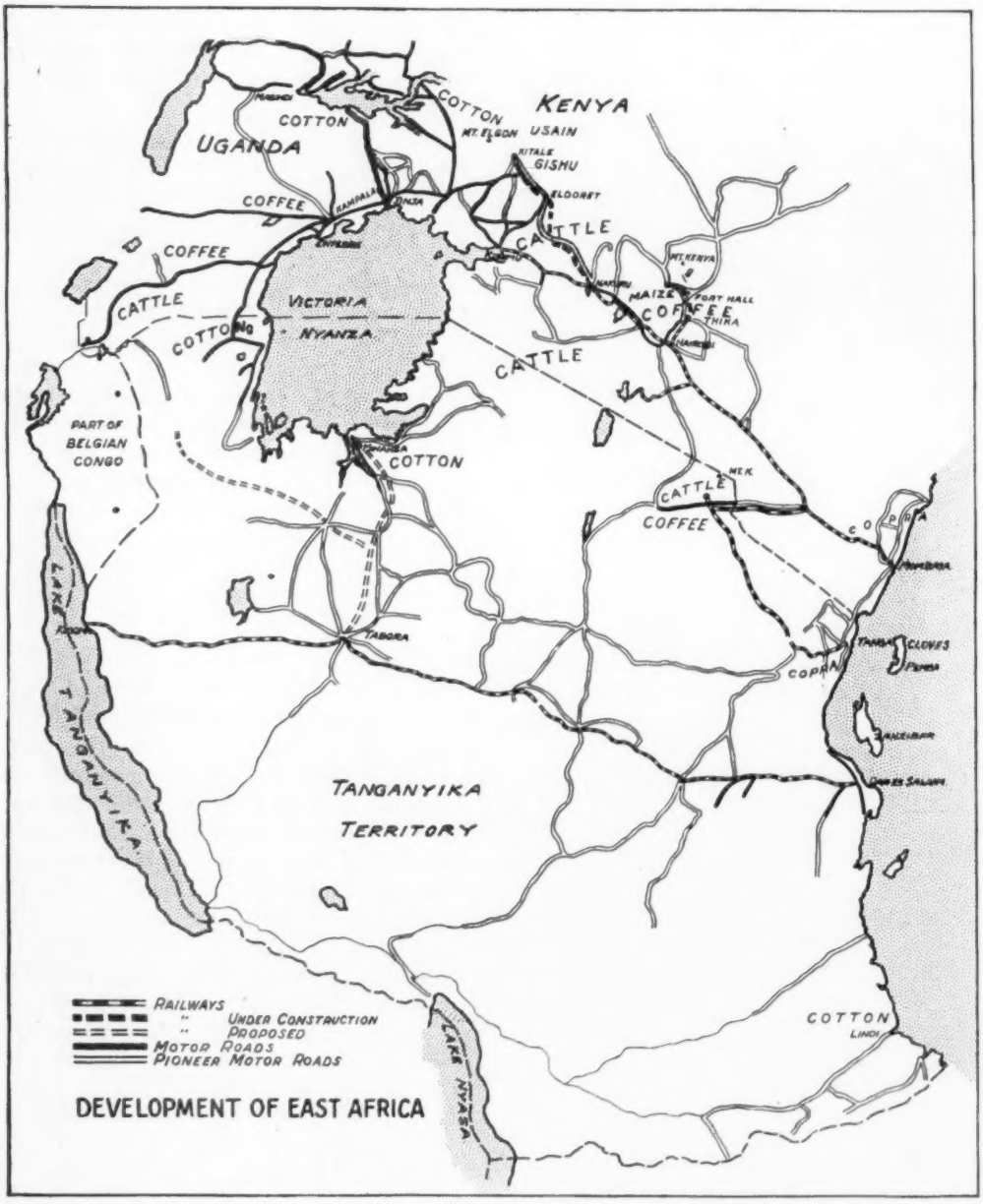


FIGURE 14.—Communications in Kenya, Uganda, and Tanganyika. The map shows the four main areas of development: 1. The Highlands between Nairobi and Lake Tioga; 2. The Highlands between Lake Victoria and Ruwenzori; 3. The region between Mwanza and Tabora, south of Lake Victoria; and 4. The districts about Mt. Kilimanjaro.

ba, famous for cloves and copra, are the chief. In early days, when Arabs held the monopoly of trade, Zanzibar was the great emporium. Today (Fig. 14) ports on the mainland at a railway terminus are vastly more important than an off shore island. Thus from Mombasa the railway climbs the plateau, crosses the rift valley, and has its inland terminus at the lake port of Kisumu. At Nairobi a branch line runs to the foothill country of Mt. Kenya (Fig. 15). Recently a new trunk line has been approved and is under construction to connect the newly

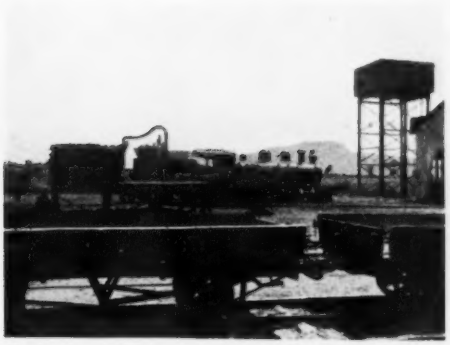


FIGURE 15.—A wood-burning locomotive on the Uganda Railway. Fuel is stacked on the trestle beside the tender.

developing plateau of Uasin-Gishu with the existing line at Nakuru. While in possession of what is now the British mandate territory of Tanganyika Territory, the Germans constructed a railway from Tanga to the foothill country of Kilimanjara, and from the capital of Dar-es-Salaam built the Central Railway via Tabora to the shores of Lake Tanganyika at Kigoma. The scheme provided also for a line from Tabora northwestwards to the mountain country of Ruanda west of Lake Victoria. Though the eastern part of Kenya and the southern area of Tanganyika Territory may ultimately be opened up, the great region of actual and potential development may be said to be the highland areas almost surrounding Lake Victoria and having their outlet eastward to a group of ports comparatively close together and offset by the islands of Zanzibar and Pemba. The native peoples vary considerably from each other in this land of marked variation of relief, of climate and of natural vegetation (Fig. 16). Over the great pasture lands east of Lake Victoria, Masai warriors keep large herds of native cattle. The Wakikuyu, their neighbors on the flanks of Kenya cultivate maize and yams and obtain various fruits. North and west of Lake Victoria highly organized African peoples are found, many combining pastoral pursuits with agriculture (Fig. 17).

FIGURE 16.—Kikuyu station, on the Uganda Railway, where primitive Africa and modern Europe meet in economic and political intercourse.

This region produces almost the total cotton export, the cotton forming a native rotation crop. The modification of equatorial heat by altitude makes possible the settlement of Europeans on the highlands of West Kenya and the adjacent areas of Uganda. The complications which arise from this British population, together with a larger Indian population must necessarily be passed over.[14] From an economic standpoint the plantations offer possibilities for stock-raising and cultivation of maize, coffee, cotton, sisal, sugar, wheat, tropical and temperate fruits. In one respect the future turns upon adequate communications (Fig. 18), as is evident from the Report of the East African Commission. Motor roads extend from very definite nuclei, especially in the direction of European estates and the rapidly developing lands of Buganda and Ruanda.

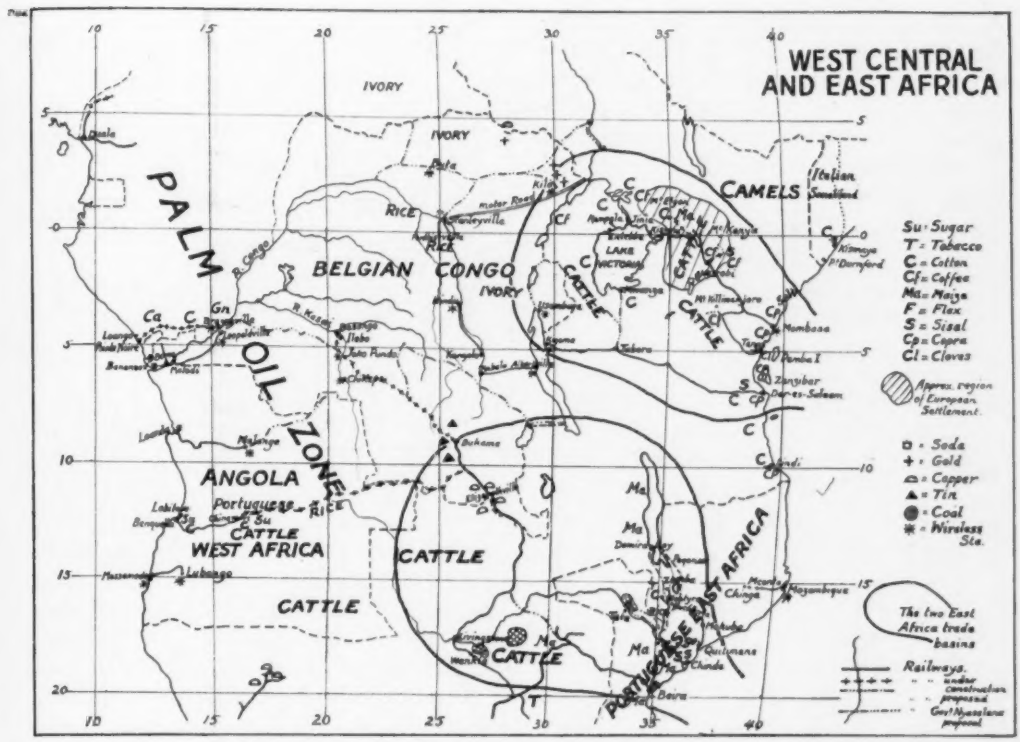
FIGURE 17.—Motor road through Uganda. It is by such motor roads as these that communication is being established in advance of the railways, and tributary to them, throughout Africa. Uganda is even now quite generally accessible. (Courtesy of the Visual Instruction Committee, Great Britain.)

NYASALAND

In the south, the center of economic development may be said to be the Protectorate of Nyasaland (Fig. 19). Though adjacent to north and west with other British territory its natural and actual outlet is by the Shire River valley and thence through Portuguese territory either via the Zambezi to Chinde, or via the Trans-Zambezi railway to the port of Beira. The Mlanje plateau and the Shire Highlands in the south and southeast have long been developed by European missions and settlers. Maize, tobacco, cotton and coffee form the principal productions for export. Plantations have steadily extended through the highlands west of the lake, but again, communications ensuring cheap transport determine the rate of development of the export and therefore the import trade. Internally native stock-raising and general agriculture shows a steady improvement but these changes, important as they are, do not enter into the present discussion. The lake, the Shire River, and the Zambezi would appear to form the natural highway of trade. In the early days this was so. Since 1905, and especially since 1912, fluctuation in the level of the lake surface has so diminished the volume of the Shire River that the river has ceased to be of value.[15] The railway from Blantyre to Port Herald, afterwards extended to Chindio on the Zambezi, was constructed in order to overcome the difficulty of river navigation and to link the protectorate with the Zambezi. The route for the extension of this railway northwards has been for some time a matter of keen controversy. The official proposal is to construct a line through the eastern dis-

[14] The problem is discussed in *Kenya*, N. Leys, Hogarth Press, 1925. See also *Indians in Kenya*, Cmd., 1922.

[15] "Lake Level in Relation to Rainfall and Sunspots," Dixey, *Nature*, Nov. 1, 1924.


WEST CENTRAL AND EAST AFRICA
IVORY
PALM OIL ZONE
BELGIAN CONGO
CAMELS
RICE
CATTLE
ANGOLA
Portuguese
WEST AFRICA
EAST AFRICA
Italian Somaliland
Mombasa
Zanzibar
Dar-es-Salaam
Nairobi
Kisumu
Kampala
Entebbe
Bukama
Elisabethville
Leopoldville
Lobito
Benguella
Lobito Bay
Lobito Bay
Lobito Bay

or Suez route, apart from the special interests of Portugal and Belgium in developing to the utmost the foreign trade of their ports. In view of the new political arrangements there has been mooted a western outlet for the Rhodesias and Nyasaland by way of Walfish Bay rather than through Portuguese East Africa.

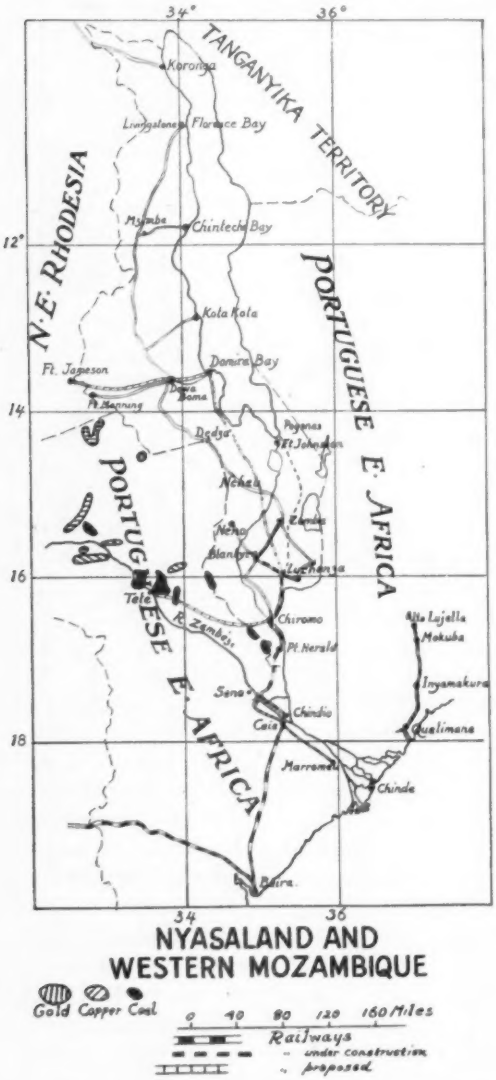


FIGURE 19.—Nyasaland and western Mozambique (Tete). The government proposes a railway from Luchenza to Pogonas on Lake Nyasa, while the traders urge the route along the western highlands to the Lake at Bomira Bay. A railway from Fort Jameson would give northeastern Rhodesia an outlet by way of Nyasa, and another from the Tete coalfield would develop the mineral wealth of this part of Portuguese East Africa.

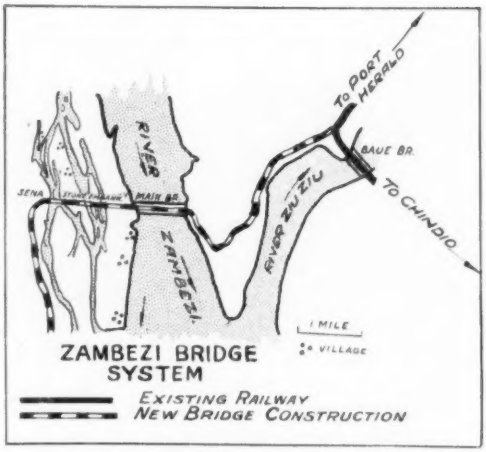


FIGURE 20.—The new Zambezi Bridge which will link Nyasaland with Beira.

But traffic has set steadily through the British enclave at Beira and any reversal or check upon its progress is not at present seriously to be expected.

Railway and road development, the extensive north-south stretches of inland waters, above all the consolidated extent today of British territory have revived the possibility of a British Cape-Cairo scheme comparable with the French trans-Saharan and Equatorial Africa scheme. It is interesting to note that the scheme which has of late been most in evidence is one that passes west of the Great Lakes, through Belgian Congo. It emphasizes too the great separation at present existing between the Kenya-Uganda-Tanganyika economic region of the north and the Nyasaland-Rhodesia economic region to the south.

A possible alternative route[16] using existing railways and lake steamer services would follow the Rhodesian railways to Beira, thence north to Lake Nyasa, whence in the future a railway might well link with Tanganyika. Thence one might go from Kigoma to Tabora, and from Tabora along the projected line to Mwanza and Lake Victoria. The Busoga line avoiding the Ripon Falls links with Lake Kioga and

[16] "The Cape-to-Cairo Railway and Train Ferries," Wilson Fox, *G. J.*, Feb., 1920.

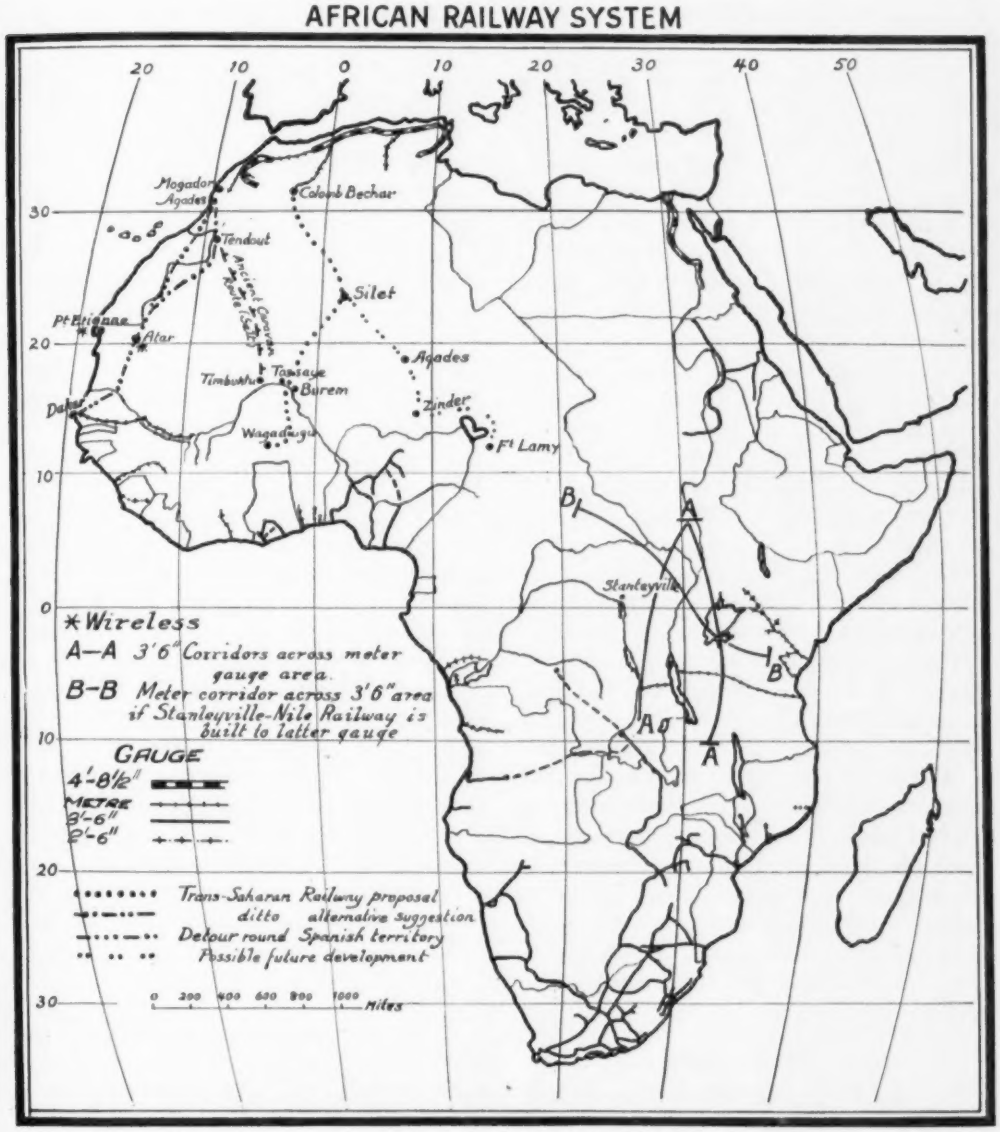


FIGURE 21.—Trans-Saharan railways and the field for the "battle of the gauges," a battle which will most likely be fought out in the Belgian Congo, with the decision resting in the main upon the gauge—at present undecided—of the Stanleyville-Nile Railway. An all-British route would require a new gauge line through Tanganyika and Uganda.

the Nile to Masindi Port. At present a motor road unites Masindi with the navigable Nile at Nimule whence by steamer and rail the journey can be made to Cairo.

Such a route is however more for the tourist than for the trader who desires to get goods to the nearest ocean port at the minimum cost. The development has proceeded far enough to raise in an acute form the question of gauges (Fig. 21). The African systems include 2 ft., 2 ft. 6 ins., 3 ft., meter, 3 ft. 6 ins., and 4 ft. 8½ ins., gauges. Egypt, Algeria, Tunis, and Morocco have, with certain exceptions the standard gauge of 4 ft. 8½ ins. French West Africa has a meter gauge, while Sierra Leone has a 2 ft. 6 ins., and

the Gold Coast and Nigeria 3 ft. 6 ins., with certain light railways of lesser gauge. The East Africa systems are also on the meter gauge, but northward the Sudan railways, and southward the Rhodesian, Angola and Nyasaland railways are on the 3 ft. 6 ins. gauge. Any east-west continental link therefore, such as the Stanleyville-Nile corridor would need to be of meter gauge, whilst any north-south link, either through Belgian Congo or Tanganyika would need a 3 ft. 6 ins. gauge with even then a change of gauge at Luxor. The battle of the gauges, if fought out at all, is likely to be in Belgian Congo, and will presumably be determined by the respective advantages of an east-west or north-south trans-continental route.

The "Dark Continent" has been opened up, and along the great avenues of trade the culture and influence of Europe passes with the manufactured goods. What will return with raw material and foodstuffs? How will the dual mandate work? The civilized nations have at least recognized that while on the one hand the abounding wealth of the tropical regions of the earth must be developed and used for the benefit of mankind, on the other hand an obligation rests on the controlling power not only to safeguard the material rights of the natives, but to promote their moral and educational progress.

NOTES ON AUTHORITIES

For the British colonies the official documents are the Colonial Reports issued annually and which are really abridgements of the annual reports prepared by each colony. The following handbooks are official or semiofficial and are invaluable: *The Gambia*, H. F. Reeve (Murray); *Sierra Leone*, T. N. Goddard (Grant Richards); *The Gold Coast Handbook* (Crown Agents for Colonies, *The Nigeria Handbook* (Crown Agents); *Handbook of Uganda*, H. R. Wallis (Crown Agents); *Handbook of German East Africa* [*Tanganyika Territory*] (H. M. Stationery Office); *Handbook of Nyasaland*, S. S. Murray (Crown Agents).

The Peace Handbooks issued by the Historical Section of the Foreign Office (H. M. Stationery Office) form an invaluable digest of available literature to date on all parts of British and Foreign African possessions. The Government issues also, from time to time, Overseas Trade Reports on foreign colonies.

The developments in French territories may be studied in the "Bulletin du Comité d'Études Historiques et Scientifiques de l'Afrique Occidentale Française" (quarterly) and the publications of l'Agence Économique de l'Afrique Occidentale Française (monthly), 27 boulevard des Italiens, Paris II, and the Gouvernement de l'Afrique Équatoriale Française, 217 rue Sainte-Honoré, Paris.

The author desires to acknowledge the valuable assistance of Miss A. L. Riley, B.A., in the preparation of maps and material.

THE APPLE INDUSTRY OF THE ANNAPOLIS-CORNWALLIS VALLEY

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Professor of Geography, University of Chicago

PART II

MARKETING PERFORMANCES IN THEIR RELATION TO THE NATURAL ENVIRONMENT

APPLES in the Annapolis-Cornwallis Valley are raised primarily for export. In fact, the industry so definitely depends upon its overseas trade that a permanent decline in exports would lead to a corresponding decline in the industry. The relation of exports to production is shown in Table III.

TABLE III

PRODUCTION AND EXPORTS OF NOVA SCOTIAN APPLES FROM 1911–12 TO 1924–25, INCLUSIVE *

Year	*Production (barrels)*	*Export (barrels)*	*Per Cent Exported*
1924–25	1,672,663	1,012,002	61
23–24	1,815,932	1,259,569	69
22–23	1,881,758	1,234,928	65
21–22	2,062,809	1,209,930	58
20–21	1,451,618	1,044,837	71
19–20	2,171,832	1,485,924	68
18–19	500,000	210,005	42
17–18	744,730	*None*	..
16–17	680,568	381,361	56
15–16	612,412	307,645	50
14–15	973,222	692,834	71
13–14	644,520	422,986	65
12–13	983,229	749,314	76
11–12	1,730,496	1,178,695	68

In a normal year approximately 60 per cent of the crop is shipped out of the province. In 1920–21, 71 per cent was exported and during the five-year period from 1920 to 1925 the exports averaged 65 per cent of the production. The close resemblance of the trend of production and export shows that in general the exports rise and fall with production, and suggests a steady demand for Nova Scotian apples. Naturally, profits to the growers vary with prevailing prices as well as with the quantity produced, but the important fact is that year by year a market exists for this fruit. In some fruit districts this does not appear to be the case. The sight of fruit hanging on the trees because no market exists for it, is all too familiar in many fruit-growing areas. While in general agriculture in Maritime Canada is handicapped by a similar inability to market the crops produced, ordinarily this is not true of the apple industry. It is this characteristic more than any other on which the success of the industry depends, and an explanation of it reveals the outstanding geographical asset of the apple industry in Nova Scotia. Curiously enough, this same condition almost as definitely constitutes a geographical liability to much of the agriculture of the Maritime Provinces.

* Courtesy of United Fruit Companies of Nova Scotia, Limited, in conference with the freight and fruit departments of the Dominion Atlantic Railway. Figures include apples packed in boxes, converted at a ratio of 3 boxes to 1 barrel. Production in 1918 is an estimate appearing in Ann. Rept. of the Sec. for Agric., N. S., 1918, p. 78. Exports in 1917 were embargoed.

MARKETS FOR NOVA SCOTIAN APPLES

The trade in Nova Scotian apples is illustrated by the disposal of the crop in

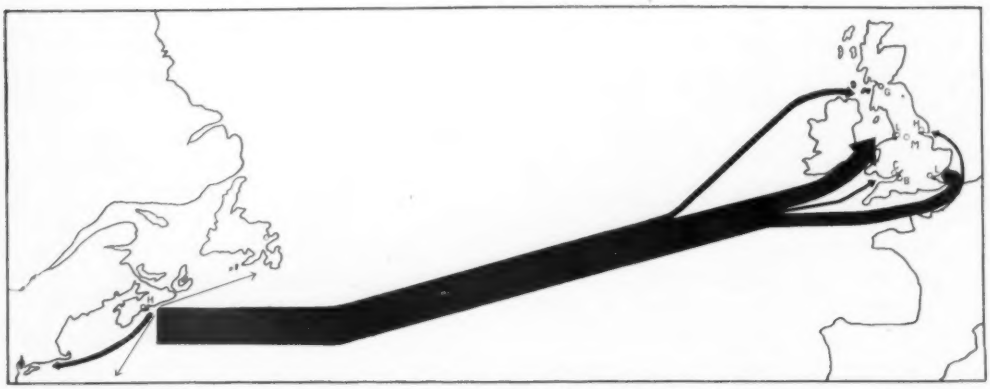

FIGURE 14.—The distribution of the exports of apples from Nova Scotia in 1921–22. Sixty-six per cent were shipped to Great Britain, of which 33 per cent went to Liverpool and Manchester, 17 per cent to London, 10 per cent to Glasgow, 3 per cent to Cardiff and Bristol, and 3 per cent to Hull. In addition 6 per cent were exported to the United States, 1 per cent to Newfoundland, and less than 1 per cent to the West Indies. Twenty-seven per cent were consumed in Nova Scotia, either in local markets or in factories. Practically all of the exports moved through the port of Halifax.

1921–22 (Table IV), and by Figure 14, which shows the distribution of the exports. Great Britain is the principal market, and in the year in question 66 per cent of the crop moved to British ports. Without this trade the industry would not have developed to its present size and importance (Fig. 15). The exports to Newfoundland are customary business, for the fishing fleets and villages, the logging camps, the paper and lumber mill communities, and the city of St. Johns import much food and other supplies from Prince Edward Island and Nova Scotia—the nearest agricultural areas. The small export of apples to the West Indies represents an outgrowth of the much larger trade in fish and potatoes which long has been carried on between Maritime Canada and the West Indian and Caribbean islands. The item not representative of the trade in every year is the export to the United States. At rare intervals Nova Scotian apples are sold in considerable quantities in Eastern United States, the amount varying according to the size of the crop in Western New York, Maryland-Virginia, and other districts which normally supply the American markets. Shipments to other Canadian provinces, ordinarily small, are principally to New Brunswick. At times, however, when the crop in Ontario is short, shipments to interior Canada reach considerable quantities. In some years small quantities of Nova Scotian apples are shipped to Norway, Sweden, Germany, and other markets.

TABLE IV

DISPOSAL OF THE APPLE CROP OF NOVA SCOTIA IN 1921–22, AND IN 1923–24 (BARRELS)*

	1921–22	*1923–24*
Liverpool	311,136	323,143
London	283,501	457,955
Manchester	260,204	429,128
Glasgow	159,147	103,189
Hull	52,109	48,982
Cardiff	35,127	23,714
Bristol	12,743	11,240
Newfoundland	13,402	14,258
West Indies	4,683	4,437
United States	98,354	.....
St. John local	.....	24,312
Moncton local	.....	4,325
Other points in New Brunswick	.....	16,347
Other points in Canada	.....	9,116
Halifax local	.....	27,720
Used in evaporators, cider mills, vinegar plants	256,297	112,848
Estimated home consumption	.....	225,000
Total	1,686,703	2,018,896

*Figures for 1921–22 from Halifax Board of Trade, for 1923–24 from United Fruit Companies of Nova Scotia, Limited. Total for the latter year includes 6,846 boxes of apples exported to Great Britain, but not listed in the table because the port of destination was not indicated in the source from which the table was compiled. Three boxes equal one barrel.

PLACE OF NOVA SCOTIA IN BRITISH IMPORT TRADE IN APPLES

The trade between Nova Scotia and Great Britain is an outgrowth of the large consumption of apples in the industrial and commercial centers in England and Scotland. Although a considerable quantity of apples is produced in the agricultural districts of southeastern and southwestern England, the local crop is not sufficient to meet the demands of the British market and consequently approximately 3,000,000 hundred weight are imported annually. The English fruit has a local reputation for quality, and the preference of the British consumer for certain varieties long grown in England finds expression in the varieties grown in Nova Scotia and other districts catering to the British trade[51] (Fig. 16). Historically apple culture in Nova Scotia and in the other apple districts of Canada and the United States is an offshoot of the early development of this fruit in the Mother Country, for many of the commercial varieties and much of the knowledge of apple culture developed in England.

As Great Britain is the principal country importing apples, the survey of its imports carried by the preceding Table V is representative of the world's overseas trade in this commodity. Of the imports into Great Britain in recent years 70 per cent or more came from North America, 10 to 18 per cent from distant Australia, and approximately 10 per cent originated in near-by countries of western Europe. The apple districts in these European countries are, with the exception of those in Germany, near the coast and therefore only a short sea haul is required to place fruit in London and other cities on the east coast of England. The increasing imports from Australia (principally of Tasmanian apples) arrive in the early summer and therefore for the most part do not compete directly with those from the Northern Hemisphere districts. As a result of this Australian trade, apples are on sale in England practically throughout the year. The trade from North America, the largest long-distance overseas movement of apples (and probably of any fresh fruit) in the world, is divided about equally between United States and Canada, the total from the former normally being slightly in excess of that from the latter. While exports from the United States to all countries make up considerably less than 10 per cent of its total production of commercial apples, and while no United States district depends primarily upon export business, nevertheless exports of raw and dried

TABLE V

IMPORTS OF APPLES, RAW (NOT LIABLE TO DUTY) INTO UNITED KINGDOM FROM PRINCIPAL COUNTRIES, 1913, 1921, 1922, 1923*

(Hundredweight [112 lbs.])

Countries	*1913*	*1921*	*1922*	*1923*
United States	1,386,500	1,712,822	1,504,903	2,940,203
Canada	1,264,223	1,494,052	1,642,711	1,859,601
Australia	275,760	387,219	836,521	974,907
Portugal	115,264	70,301	32,686	37,890
Belgium	59,474	104,192	177,128	153,516
France	80,874	69,818	48,768	289,542
Netherlands	28,512	126,254	101,415	126,889
Germany	2,147	6,323	22,508	15,198
Channel Islands	16,620	5,937	1,577	1,597
All other countries	28,045	5,186	39,909	29,207
Total	3,257,419	4,001,134	4,471,839	6,473,397

* Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions, 1914, Vol. I, p. 117, 1923, Vol. II, p. 30.

[51] Shaw, P. J.: "Horticulture in Nova Scotia," *Ann. Rept. Sec. for Agric., Nova Scotia, 1910*, Pt. II, p. 4.

FIGURE 15.—Nova Scotian apples ready for shipment to Great Britain. The view was taken more than a decade ago, when the industry was not so highly organized as it is at present. (Courtesy of Natural Resources Intelligence Service of Canada.)

apples add materially to the success of the industry in the seaboard and far western districts. Of the exports of raw apples from the United States, approximately 70 per cent go to Great Britain, and therefore the British market is the crux of its export business. Of Canadian exports to Great Britain, Nova Scotian apples normally make up 80 per cent. Thus Canadian participation in this trade rests primarily on the ability of the Annapolis-Cornwallis District to compete with other producing districts, especially those in eastern United States. To Nova Scotia, the British business is the life blood of the industry, for no other important market is open to its fruit.

ISOLATION OF NOVA SCOTIAN APPLES FROM UNITED STATES AND CANADIAN MARKETS

In order to recognize the importance of the British market to the Annapolis-Cornwallis District, the general structure of the apple trade of eastern North America should be understood. The principal market and therefore the keystone of the whole structure is the manufacturing and commercial region lying along the seaboard from Boston to Baltimore and extending westward to include the mining and manufacturing communities of Pennsylvania. Normally the barrel apples for this region come from near-by producing districts, of which Western New York has the largest production. Nova Scotian apples as a general rule do not compete in these industrial markets because they find an attractive outlet in Great Britain, because of the entrenched position of Western New York and other districts of eastern United States in the business, and because the Tariff Act of 1922 imposes on apples an import duty of 25 cents per bushel of fifty pounds,[52] or about 75

[52] From 1913 to 1921, the tariff was 10 cents per bu., under the Emergency Tariff Act of 1921 it was 30 cents per bu.; communication from the Legal Division, United States Tariff Commission, under date of Dec. 24, 1924. See also, "Apples, Green or Ripe, and Dried," *Tariff Information Surveys, Paragraph 217 (in part) of the Tariff Act of 1913, U. S. Tariff Commission, 1921.*

FIGURE 16.—A Gravenstein apple tree heavily laden with its harvest of lucious fruit. The preference of the British consumer for certain varieties long grown in England, finds expression in the varieties grown in Nova Scotia and other districts catering to the British trade. (Courtesy of A. L. Hardy, Kentville, N. B.)

cents per barrel. When this charge is added to the cost of a much longer rail haul or to that of an additional handling if the fruit is shipped by water, it is evident that normally Nova Scotian fruit can not compete with the domestic product in the important markets of northeastern United States. However, in years of small yield in eastern United States, as in 1919, when apple production in the United States was only 48 per cent of a full crop, and in 1921, when it was only 33 per cent,[53] Nova Scotian apples move into the United States in considerable quantities (Fig. 17).

Apples grown in the Annapolis-Cornwallis District are cut off from Canadian markets almost as effectively as from the United States, for normally the cities of the St. Lawrence Lowlands and the mining and lumbering communities of the Laurentian Upland are supplied principally from Ontario and Quebec. On account of their central position these apple districts hold a command in the Canadian trade similar to that of Western New York in the markets of the United States. In the Prairie Provinces, where the climate is unsuited to apple culture, the markets are supplied from Ontario, from the United States, and from young orchards in British Columbia.[54] Nova Scotia is too far from either the central or western markets to compete for their business. The necessarily long rail haul eliminates Nova Scotia from these markets just as it handicaps the Ontario districts in competing with Nova Scotia in overseas business. Shipments via the St. Lawrence are impracticable because few if any services are maintained between Nova Scotian ports and Montreal, and because navigation on the St. Lawrence closes early in the apple shipping season. However, in seasons when the Ontario and Quebec crops are short, Nova Scotian apples move in considerable quantities into central Canada and at times even reach the Prairie Provinces.[55] Thus in 1917 when an embargo prevented shipments to Great Britain, a greatly reduced crop in Ontario and eastern United States made possible extensive shipments to continental markets.[56]

NOVA SCOTIAN ASSETS IN TRANSATLANTIC APPLE TRADE

In marketing apples, the continued success of the apple industry in the

[53] *U. S. Yearbook of the Dept. of Agric., 1923*, p. 732.

[54] In 1915, as the result of a vigorous campaign on the part of the British Columbia and Ontario fruit growers' associations, the Dominion Government increased the tariff on apples to 90 cents per barrel, in order to give "adequate relief against American competition." To the writer it appears geographically significant that the movement for protection was initiated by the Ontario and British Columbia producers, to whom the Canadian markets are vital, rather than by the Nova Scotia producers, to whom the continental markets are incidental. See "Apples, Green or Ripe, and Dried," *Tariff Information Surveys, op. cit., 1921*, p. 15.

[55] In the season of 1922–23 the United Fruit Companies of Nova Scotia shipped 50,299 barrels to Quebec and 14,639 to Ontario. As these companies do not control the entire crop, additional shipments from Nova Scotia to those provinces probably were made. *Minutes and Proceedings of the Eleventh Annual Meeting of the United Fruit Companies of Nova Scotia*, 1923, p. 18.

[56] *The Morning Chronicle*, Halifax, Jan. 2, 1922.

FIGURE 17.—A load of barrels for the apple harvest. In years of small yield in eastern United States, as in 1919, and again in 1921, Nova Scotia apples move into the United States in considerable quantities. (Courtesy of the Canadian Pacific Railway.)

Annapolis-Cornwallis District is due to the relatively low cost and the effectiveness with which its product is placed in the British markets. These advantages are an expression of an outstanding geographic asset, namely the position of the producing district in relation to Great Britain via the North Atlantic Trade Route. In this respect it has advantages as compared with other North American fruit districts.

IMPORTANCE OF HALIFAX IN OVERSEAS TRADE IN APPLES

The North Atlantic trade in apples consists primarily of shipments from New York and Halifax to Liverpool, Manchester, London, and Glasgow. The total volume of the trade and the proportions from and to the individual ports varies somewhat from year to year, but essentially the structure of the trade is displayed in the following Table VI. In the season of 1923–24, 82 per cent of all apples exported from North America and 90 per cent of those in barrels were from the two ports of New York and Halifax. Into Great Britain, 73 per cent of the imports entered via the four great ports of Liverpool, London, Manchester and Glasgow, and 52 per cent of the total entered through Liverpool and London. The table also suggests the nature of the business at the several ports. From New York go apples in barrels from a number of producing districts near that port, and also large quantities of fancy box apples, most of which originate in the Pacific Northwest. From Halifax practically the entire export is of apples in barrels from the Annapolis-Cornwallis District. Ca-

TABLE VI

OVERSEAS TRADE IN UNITED STATES AND CANADIAN APPLES, IN 1923–24, SHOWING PORTS OF ORIGIN AND DESTINATION *

	Barrels	*Boxes*
Ports of origin:		
Portland, Me.	48,023	3,084
Boston	115,379	137,309
New York	1,654,896	3,667,938
Philadelphia	40,839	13,228
Baltimore	2,949	.....
Norfolk, Va	18,808	6,837
Seattle	.....	449,786
Portland, Oregon	.....	542,030
San Francisco	.....	68,988
Montreal	43,549	487,256
Halifax	1,250,859	1,191
Quebec	3,283	16,474
St. John	27,524	43,472
Vancouver, B. C.	.....	11,141
	3,206,109	5,448,734
Ports of Destination:		
Liverpool	1,148,172	1,375,761
London	659,209	1,107,924
Glasgow	416,313	668,937
Manchester	377,795	191,264
Southampton	139,157	472,667
Other British ports	270,452	299,764
Scandinavia	125,204	500,481
Bremen	.....	18,610
Hamburg	40,699	436,743
Rotterdam	6,839	257,423
Amsterdam	.....	3
Belfast	2,732	2,680
South America	19,072	110,597
Alexandria, Egypt	465	5,880
Total apple exports from U. S.	1,880,894	4,889,200
Total apple exports from Canada	1,325,215	559,534
Grand total	3,206,109	5,448,734

Grand total stated in barrels (1 barrel equals 3 boxes)—5,022,354 from United States and Canada.

* Released by United Fruit Companies of Nova Scotia, Limited.

nadian box apples originate principally along the Canadian Pacific Railway in British Columbia and are shipped via that line for export at Montreal or its winter port, St. John. Exports of boxed apples from Vancouver, Seattle, and Portland mark a growing trade via the Panama Canal. At Liverpool and Manchester by far the larger proportion of the imports in the year under survey were a barrel pack destined for the industrial cities tributary to those ports. At London and Glasgow, box apples make up a greater fraction of the imports. This fact possibly indicates a proportionally larger demand for fancy apples in those cosmopolitan centers.

LOW RAIL RATES TO POINT OF EXPORT

The seaboard position of the Annapolis-Cornwallis Valley gives it a short and cheap rail haul to the point of export. Digby at its western end and Kentville in its center are by rail only 151 and 72 miles respectively from Halifax (Fig. 2, Part 1). Most places in the district enjoy a minimum freight rate and can place apples on the docks in Halifax in from twelve to fourteen hours after they leave the warehouses. With respect to proximity to either of the two major exporting points, viz., New York and Halifax, the Annapolis-Cornwallis District has an advantage as compared with other United States and Canadian districts, with the possible exception of the Hudson Valley District in New York. This advantage translates into a lower rail rate. In the current season shippers in the Annapolis-Cornwallis Valley have enjoyed an advantage in the rail rate to the point of export, of eight cents as compared with Western New York, and of twenty-one cents in the case of Ontario (Table VII). As this advantage has prevailed in other years,[57] it may be taken as a long-run or permanent asset. The higher insurance rate from Montreal shown by the table as compared with the rate from Halifax and New York represents the customary differentiation among these ports in this respect. Moreover, navigation on the St. Lawrence closes before the apple-shipping season gets well under way, thus eliminating Montreal as an exporting point and greatly increasing the length of the rail haul required for the export of Ontario fruit. This condition seriously handicaps Ontario in competing in the overseas markets.

TABLE VII

TRANSPORTATION CHARGES FOR SHIPMENTS OF APPLES TO LONDON FROM THE ANNAPOLIS-CORNWALLIS VALLEY, FROM ONTARIO, AND FROM WESTERN NEW YORK, IN THE SEASON OF 1924–25*

Charges per Barrel	*Annapolis Valley via Halifax*	*Ontario via Montreal*	*Western New York via New York*
Inland Rail	$.37	$.58	$.45
Ocean Freight	.90	.90	.90
Insurance	.02½	.04	.02½
Dock dues, Port rates, etc.	.26	.26	.26
London Clause Chg.	.03	.03	.03
Commission of 5% on gross sales	.50	.55	.55
	$2.08½	$2.36	$2.21½

* Courtesy Bureau of Canadian Information, Canadian Pacific Railway.

The Dominion Atlantic Railway handles practically all of the apples shipped from the Annapolis-Cornwallis District to Halifax (Fig.18). In fact, in Kings and Hants Counties it is the only railroad. As apples for export represent an important part of the freight handled by this road, it endeavors to handle them to the satisfaction of the fruit companies and other shippers. In the winter most of the fruit moves in refrigerator cars, for

[57] *Annual Report of the Fruit Growers' Association of Nova Scotia, 1916*, p. 14.

otherwise the apples might be injured by frost. During the spells of extremely cold weather occuring in some winters, the transfer of apples from the cars to the ships at Halifax is suspended. The Halifax representative of the United Fruit Companies in 1922–23 pointed out that "there were days when it was impossible to move cars in the yards and when it was not fit to open the hatches of the ship on account of the severe cold." [58] He called attention to the need of a large heated car shed at Halifax to protect apples waiting to be transferred to the ship. Although the need for this improvement is endorsed by the Halifax Board of Trade and the provincial government, its accomplishment is difficult because the railway yards and the railway facilities at the deep water terminal in Halifax are controlled by the Intercolonial Railway. As this organization receives practically none of the revenue from carrying apples, naturally, it does not consider practicable large expenditures to facilitate the fruit shipments.[59] The matter is complicated by the fact that the Dominion and Atlantic is a subsidiary of the Canadian Pacific System and that the Intercolonial is one of the Canadian National lines. To a slight extent, therefore, this question of railway ownership handicaps the establishment of a more scientific adjustment of the facilities at the port to the business of one of its principal tributary areas. However, because of the generally satisfactory terminal lay-out at Halifax, apples apparently are handled there as expeditiously as at any North American port (Fig. 19).

FIGURE 18.—The Annapolis Valley, looking west towards Annapolis Basin. A main road and a railroad show on each side of the river and illustrate the way in which roads and railroads are adjusted to the longitudinal trend of the lowland. The railroad on the farther side of the river is the Halifax and Southwestern and serves only the western end of the apple district. The Dominion and Atlantic Railroad, the principal carrier in the area, lies on the near side of the river. It crosses the white line of the highway in the lower right-hand corner of the picture. (Courtesy of Royal Canadian Air Force.)

POSITION OF HALIFAX ON NORTH ATLANTIC TRADE ROUTE

The development of the apple industry in the Annapolis-Cornwallis Valley has been favored by the position of

[58] *Minutes and Proceedings of the Eleventh Annual Meeting of the United Fruit Companies of Nova Scotia, Limited, 1923*, p. 40.

[59] *Ibid.*

the port of Halifax on the North Atlantic Trade Route. Most of the apples shipped from Halifax to United Kingdom ports are carried as part cargo in first-class cargo liners. The usual passage from Halifax to Liverpool consumes from eight to nine days, although the faster ships make the voyage in seven-and-a-half days. The voyage to London takes a day or two longer. The shipments carried by a single vessel average between 10,000 and 20,000 barrels. The fruit is placed in ordinary stowage, damage from foul air and gases being prevented by artificial ventilation. Small quantities of fruit are carried by passenger liners and at times a steamer is chartered for the trade. The departures from the usual custom of shipping on the cargo liners in the past have been made as experiments or as protests against the rates charged by the liners. Thus in 1920, when the rate on apples from all seaboard ports in America to Great Britain was $2.50, the United Fruit Companies of Nova Scotia chartered twenty-two Norwegian fruit steamers and, certain other exporters doing likewise, the rate on the regular liners was reduced to $1.25 per barrel.[60]

Although apples, as compared to many fruits, ship well, nevertheless they must be handled carefully and move quickly if they are to reach the markets in first class condition. On account of the care with which some of the cargo liners handle the fruit, some of the shippers consider space on a cargo liner worth at least 25 cents more than that on a chartered vessel. Thus in the season of 1922–23 the officials of the United Fruit Company chose to ship via the regular services furnished by Furness, Withy and Company, although the rate charged was 25 cents per barrel more than some

FIGURE 19.—The port of Halifax, looking north across the commercial section of the city and the broad roadstead.

[60] *Ibid.*, pp. 34–6.

shippers paid on chartered ships. It was argued that the better condition of the fruit upon arrival, together with a lower insurance rate, more than offset the higher freight rate.[61] While apples are carried at times by the International Mercantile Marine, the Cunard, Canadian Pacific and other lines, and by vessels of the Canadian Government Merchant Marine and the United States Shipping Board, the line most interested in this trade is Furness, Withy and Co., Limited. During the shipping season this company operates regular sailings at about weekly intervals from Halifax to London, Liverpool, Manchester, Glasgow, and also occasional sailings to Hull, Belfast and other ports. In fact this company takes great pains to handle the fruit satisfactorily. Expressions of appreciation of the service rendered appear in a number of instances in the publications of the Fruit Growers Association and of the United Fruit Companies.[62]

A regular flow of apples from Nova Scotia to Great Britain is furthered greatly by the large number of sailings from Halifax to Great Britain during the exporting season. These frequent sailings are due in part to the shipping conditions prevailing on the North Atlantic at the time when the fruit is moving, and in part to the attractiveness of apples as cargo. Probably, with the exception of New York, no other port in North America is as well situated as Halifax to take advantage of these conditions. During the summer few regular overseas sailings are made from Halifax, for at that season trans-Atlantic shipments from the Maritime Provinces are small, and the St. Lawrence being open, Montreal becomes the principal Canadian port and regular services by many lines are maintained to it. In September, when exports of apples begin, an occasional vessel is diverted from the Montreal run in order to call at Halifax for early shipments of apples. Late in November, after the close of navigation of the St. Lawrence, the lines operating to Montreal in the summer shift their ships to St. John and Portland, with Halifax in many instances a port of call. A few ships at this time of the year operate directly from Halifax. However, the greater number of steamers calling at Halifax for apples, especially from September to the end of November, have their terminals at United States ports in the range from Boston to Newport News. At the terminal port, such ships take on part cargo of a general nature, some of which may be apples from one of the fruit districts in Eastern United States, and en route call at Halifax to complete their cargo by loading apples. If it were not for the apple traffic and the convenient position of Halifax on their route these ships would not call at that port. During the autumn and early winter the sea off the southeast coast of Newfoundland is free from icebergs, and therefore from September to the end of January during the period when most of the apples are exported, ships from New York and other Atlantic ports of the United States calling at Halifax can follow a direct course across the Grand Banks. A call at Halifax, therefore, involves little additional time except that spent in port. Thus precisely at the time when apples are moving, abundant tonnage and frequent sailings are available. In the season of 1922–23, the trans-Atlantic shipments of 362,598 barrels and 5,301 boxes made by the United Fruit Companies were carried in a total of one hundred and two sailings.[63] This is an average of more than three sailings per week during the shipping season from September to March inclusive.

An important feature of the export of apples to Great Britain is the necessity of regulating the amount of apples shipped to any one port at any one time. The problem arises from the relatively perishable nature of the commodity and

[61] *Ibid.*

[62] *Ibid.*, p. 23; *Fifty-Second Annual Report of the Fruit Growers' Association of Nova Scotia*, 1916, pp. 13, 40.

[63] *Minutes and Proceedings, op. cit.*, p. 41.

from the fact that cold storage facilities available in the British ports are not utilized for apples. It is complicated by the length of the trans-Atlantic voyage, by variations in the time required by ships in making the voyage, by the movement of apples to the British markets from other producing districts, and by the relatively large number of Nova Scotian shippers. Exporters agree that it is wise not to allow any one ship to carry to any one port a cargo of more than 15,000 barrels at a time, for otherwise the markets tributary to the port would be glutted. In order to regulate the trade, shipments from Nova Scotia for the most part are governed by a local organization known as the Shippers Association. In order to avoid serious conflict with other American shipments, the United Fruit Company, and probably the other Nova Scotian shippers, watch the movement of apples with great care. Once each week this company learns the exact quantities of apples shipped from all ports to all ports for the week previous, and the probable clearances for the ensuing week. Its officials know a week ahead, of all ships sailing from New York, Portland and Boston, and the space booked for apples on these ships. Interest in regulating apple shipments to the British markets probably is not matched elsewhere, for no other apple district, in America at least, depends to the same extent upon that market. In regulating shipments, frequent sailings to the several British ports are of the utmost importance. The fact that they are available attests the commercial significance of the geographic position of the port of Halifax and the Annapolis-Cornwallis District.

IMPORTANCE OF ADAPTING THE MARKETING SYSTEM TO REGIONAL ASSETS

PRESENT MARKET SYSTEM

For some years the system by which Nova Scotia apples are marketed has been in the process of change, and it bids fair to change still further in the future. At present (1925), although approximately 60 per cent of the fruit is handled by local coöperative companies, apples also are packed and consigned by individual growers and by buyers or speculators (Fig. 20). Most of the coöperative

FIGURE 20.—Though approximately 60 per cent of the fruit is handled by local coöperative companies, apples also are packed and consigned by individual growers and by buyers and speculators. Sorting and packing operations are not so well organized and executed as in the great apple-growing regions of Oregon and Washington. (Courtesy of the Canadian Pacific Railway.)

companies belong to the United Fruit Companies of Nova Scotia, Limited. This organization consigns to one or more of the several British firms through which the apples reach the retailers.[64] Some of the buyers are representatives of British importing companies and others operate independently. On account of fluctuations in price which characterize the market in many years, the job of the buyer is highly speculative. It is said that more men have failed than have succeeded at it. Certainly in order to succeed a man must be highly conversant with every aspect of the industry. Formerly buyers handled most of the crop, but since 1908 the trend has been toward coöperative marketing. This decided change has

[64] In 1922–23 most of their fruit was marketed through J. and H. Goodwin, Ltd., which firm operates generally throughout the United States and Canada and markets apples in London, Liverpool, Manchester and other British cities, *Minutes and Proceedings, op. cit.*, pp. 17, 29.

FIGURE 21.—A fishing schooner at Halifax loading apples and other provisions preparatory to a trip to the banks. The fishing fleets and villages long have constituted a small but important market for Nova Scotian farmers.

been due to dissatisfaction with the old system on the part of the farmers, and to the initiative of a small group of farmers whose success with the original coöperative company stimulated interest in coöperation. It represents an attempt to perfect a system by which a relatively perishable product may be sold successfully in an overseas market approximately 2,500 miles from the place of production. It grew out of the somewhat disorganized situation which developed as apple culture slowly evolved from an unimportant side line to a major farm interest.

EVOLUTION OF MARKET SYSTEM

Probably it is impossible to fix a date which marks the beginning of shipments of apples from the Annapolis Cornwallis Valley. Apples apparently were sold upon occasion to fishermen in Newfoundland and along the "South Shore" during much of the last century (Fig. 21). In later times the lumber and mining camps and the towns and cities of Maritime Canada probably consumed considerable quantities. However, large interest in apple culture did not appear until some time after the development of railway and steamship services opened British markets to Nova Scotian fruit. Originally shipments of apples from local ports to Liverpool and London were made in sailing vessels from the Annapolis and Minas basins. At present, however, practically all of the fruit is exported through the port of Halifax. It is estimated that approximately 20,000 barrels were exported in 1880. The progress of the business since that date is indicated in five-year averages in Figure 22. The expansion of the export trade clearly demonstrates the growth of the industry, because it is a record of the lodestone which drew the attention of the farmers to the economic possibilities of their orchards.

The first shipments of apples to the oversea markets apparently were due to the initiative of the growers, who picked, packed and consigned their fruit. Such shipments were so small in quantity that the requisite warehouses and other

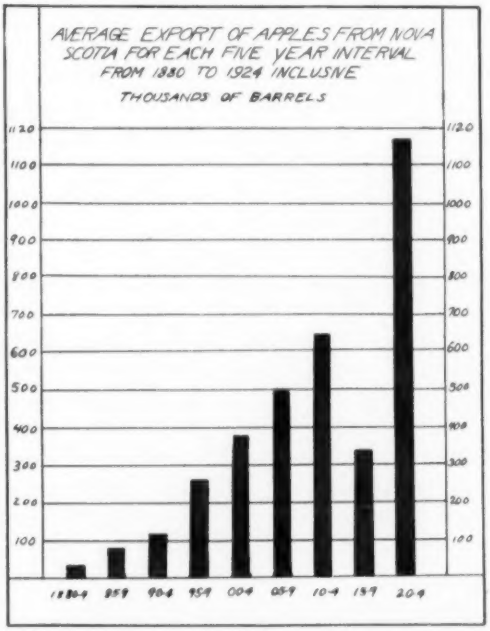

FIGURE 22.—The period covered by the graph is the period of commercial production. The small average export from 1915 to 1919 inclusive was due to the restrictions imposed on apple exports to Great Britain during the war. Data for years preceding 1911 from *Ann. Rept. of the Sec. of Agric.*, Nova Scotia, 1916, p. 7, for subsequent years from the United Fruit Companies of Nova Scotia, Limited.

facilities were not provided, and not infrequently the apples arrived in Britain in such shape that little or nothing was received for them. However, the demands of the British markets and the quality of the Nova Scotian fruit kept the business alive, and in time English commission houses established agencies in the province during the shipping season. These agencies hired representatives at the numerous villages which served as shipping points. The function of the latter was to combine the small lots purchased from the individual farmers into carloads which were forwarded to Halifax for export.[65] In due time the farmer received the account of his sale with a check for the net proceeds. In many instances after deducting the charge for freight, commission, insurance, brokerage, wharfage, lighterage, cartage, portage and other services, all of which were sometimes lumped together by the consignee as "our charges," the amount received by the farmer was below the cost of producing the fruit.[66] Moreover, the system of packing in vogue was most unsatisfactory. Except in certain outstanding cases, apparently little or no attempt was made to produce a high grade pack. As the warehouse facilities were inadequate the apples were packed more or less as they came from the tree, with little regard to size, shape or quality. In addition not infrequently the fruit was damaged en route by frost or rain, by careless handling at the port or by inefficient stowage aboard the ship.

In spite of difficulties and discouragements the business increased until the average export for the five-year period from 1900 to 1905 inclusive was 377,225 barrels. By that time many farmers had come to regard their apples as one of their important money crops, and a few were devoting much attention to their orchards. Moreover, two changes in the marketing system made in the decade

FIGURE 23.—An apple warehouse at Berwick. In this and similar warehouses, located at railway stations in the apple district, apples are sorted, graded, packed and stored for shipment.

from 1900 to 1910, greatly stimulated the industry. The first was the erection of frost-proof warehouses for sorting, grading, packing, and storing apples (Fig. 23). After the first warehouse proved successful, others were built so rapidly that by 1910 from one to six frost-proof warehouses, varying in capacity from 5,000 to 15,000 barrels, were located in every station on the Dominion Atlantic Railway between Annapolis and Windsor (Figs. 24 and 25). Some of them were built and operated by English commission houses, some by local operators and others by growers.[67]

The establishment of the warehouses led to a second change in the system by which the fruit was marketed. It is estimated that in 1900 75 per cent of the apples were consigned to the commission houses by the growers, who assumed the risk and took the profits, if any. The new warehouses made it practicable to lengthen greatly the shipping season and shortly resulted in the warehouse operators assuming the consigning risk. Under the new plan the growers sold their fruit as "tree run" to the buyer, who packed and shipped it (Fig. 23). The change in the system was so rapid that by 1910 probably 75 per cent of the crop was marketed in this way.[68] The new plan, however, did not

[65] Parker, S. C.: Coöperation in Fruit Marketing in Nova Scotia, *Ann. Rept. of the Sec. for Agric.*, Nova Scotia, 1916, Pt. III, p. 175.
[66] *Ibid.*, p. 174.
[67] *Ibid.*, p. 174.
[68] *Ibid.*, p. 175.

give universal satisfaction. Speculators without an adequate knowledge of local conditions entered the business and their subsequent failure had a demoralizing effect on the industry. On the other hand, the farmers witnessed a few buyers make tidy fortunes out of their fruit. They naturally wondered if a way could be found to spread such profits among themselves. Out of the situation came the present plan of coöperative marketing.

COÖPERATIVE COMPANIES

The first successful attempt at coöperation was inaugurated in 1907, when twelve growers at Berwick organized the Berwick Fruit Company. These men argued that by coöperating they would be able to produce a high grade pack and thus establish a reputation for the output of their company. They aimed to sell F.O.B. cars or to ship on consignment to reliable houses. Their organization proved successful from the outset, as they were able to obtain a higher price than that paid to the average grower. In addition the company earned nearly enough in commissions to pay its operating expenses. The brand of the company soon gained sufficient reputation so that some of their sales were made by cable. In its third year of operation most of the output was sold F.O.B. cars at the warehouse and cash or draft attached to the bill of lading were the customary terms.[69] The fact that the first company was organized at Berwick appears to the writer as geographically significant (Fig. 24). The community of which this village is the shipping center, spreads over the divide between the Annapolis and Cornwallis rivers and up the slope of South Mountain (Fig. 9, Pt. 1, p. 187). It is located on

FIGURE 24.—A packing room in an apple warehouse, where the apples are sorted, packed, and stored. (Courtesy of Natural Resources Intelligence Service of Canada.)

[69] *Ibid.*, p. 176. See also Chute, J. N.: Co-operation in Packing and Marketing Fruit, *Ann. Rept. of the Sec. for Agric.*, Nova Scotia, 1910, Pt. II, pp. 50–52.

the highest position on the floor of the longitudinal valley which these streams drain, and where therefore the hazards from frosts are reduced to a minimum. Moreover, much of the soil is too sandy for mixed farming. In this community as high a degree of specialization in apple culture is attained as anywhere in the area, and a number of men in this community long have been prominent in the horticultural affairs of the province.

Once the success of the original company was demonstrated, the coöperative movement spread rapidly. Shortly a similar organization appeared in nearly every community in the area. In reality the Annapolis-Cornwallis District consists of a series of agricultural communities which center in the villages spaced at intervals of from two to five miles along the Dominion and Atlantic Railroad. These communities are remarkably alike in economic interests and social outlook, and consequently anything affecting the apple industry—the common denominator of them all—commands the attention of the entire area. In this connection it must be remembered that the population of Nova Scotia and especially of the Annapolis-Cornwallis Valley is remarkably homogeneous. Practically the entire population of the province is native born and of British extraction. Such newcomers as have settled in these communities have been Englishmen readily absorbed into the social fabric. Consequently social unity characterizes the area. Moreover, a custom of group discussion of common problems and mutual interests has been practiced for decades. An outstanding example is

FIGURE 25.—A frost-proof room of a warehouse in which the graded fruit is stored until it is packed and shipped. (Courtesy of Natural Resources Intelligence Service of Canada.)

the Fruit Growers' Association of Nova Scotia, formed in 1864 for the purpose of promoting educative work in fruit culture. At least once a year its members have met to discuss horticultural problems, and its records and reports constitute a virile exposition of the progress of the apple industry. Furthermore, the district is so definitely limited in its boundaries that it has been practicable for representative members from all parts of the area to attend the meetings of the organization. From discussions of varieties of apples suited to local soils, of the value of a cover crop and of the virtues of a particular spray, it is but natural that discussion and practice turned to the important job of selling apples. In this logical way, out of a heritage of common experience, and initiated by a small group willing to put their theories to the acid test of practical experience, coöperation in marketing came into practice in an area possessing social, economic and geographic unity.

FIGURE 26.—The apples now are picked either by the farmers, who augment their farm crews during the harvest, or by gangs in the employ of a buyer. The fruit is picked into baskets and hauled in open barrels to the packing houses. (Courtesy of Natural Resources Intelligence Service of Canada.)

THE CENTRAL ORGANIZATION

About 1910, when several fruit companies had demonstrated the values of coöperative marketing, a central organization called the United Fruit Companies of Nova Scotia, Limited, was formed in order to promote the common interests of the individual companies. In 1923, fifty-three out of the sixty-five coöperative companies belonged to the central organization, and that organization was marketing between 40 and 50 per cent of the apples and about 60 per cent of the potatoes grown in Nova Scotia. In June of each year a

meeting composed of three delegates from each of the individual companies is held. At this meeting the directors, a president, and a secretary are elected. The directors meet subsequently and appoint a Board of Management, from among their number, and an auditor. This board hires the general manager, the accountants, and other help necessary to the business, and is charged "with the inspection, marketing and disposal of all apples and potatoes controlled by the Company and with the purchase of articles or commodities required by the Company in which it is entitled to deal." [70] It is also empowered to charter steamships, contract for special trains, and secure through or special rates for the transportation of the produce which the organization handles. An illustration is the case of the reduction of ocean freight rates in 1920 previously mentioned. The central organization buys fertilizers, seeds, insecticides, machinery and other things needed by the growers who belong to the subsidiary companies. It manufactures in Kentville a machine and dust for dusting the orchards, and at times it has operated a canning and vinegar factory. Representatives are maintained in Halifax to look after transportation problems and sales at that port, and in Havana to promote sales of potatoes and apples. Although some advertising is done in England and in Canada, it has not developed this aspect of coöperative marketing as have the raisin and citrous fruit organizations of California. In fact this Nova Scotia coöperative is in few ways as highly organized as the California associations.

Although the central organization does not pack apples or potatoes, it exercises some influence in the quality of the pack by employing an apple and a potato inspector who travel from packing house to packing house during the packing and shipping season (Fig. 26). If poorly packed fruit is discovered it must be unpacked before it can be marked with the central company's brand. If a share-holding company refuses or neglects to repack questionable fruit, such fruit is consigned under the brand of that company alone and the proceeds from the sale are paid to the company after the expenses and charges incident to the shipment are deducted. The share-holding company in addition forfeits its share in the profits of the central organization for the year in question. While these measures have helped in the improvement of the pack local authorities agree that real progress in the improvement of the pack must depend largely upon the individual companies' coming to a realization of the importance of an improved pack.

[70] *Constitution and By-Laws of the United Fruit Companies of Nova Scotia, Limited*, p. 9.

PROBABILITY OF FURTHER EXTENSION OF COÖPERATIVE MARKETING

Apparently the principle of coöperation in marketing is thoroughly established. The question now at issue is the degree of dominance to be obtained by the coöperative movement. Although the central organization of which a majority of the coöperative companies are members has advanced coöperation beyond the original community basis and is now the most important force in the market situation, nevertheless the independent companies and buyers continue to operate successfully (Fig. 27).

FIGURE 27.—Delivering apples to the warehouse of a coöperative company at Berwick.

The relatively small size and continuity of the producing district, the homogeneity of the social group, the success of the present organizations and the sentiment which they promote, and any increase in the competition in the British markets on the part of other fruit districts, will operate toward further coöperation. On the other hand, the continued success of some growers in handling their own fruit, the satisfactory business relations which certain buyers have maintained for many years with their clientele, and the natural distrust which many farmers have of leadership from among their group, are conditions which will operate against it. Some of the men who have given considerable attention to this matter argue that the continued success of the industry on the present basis hinders, to a certain extent, any movement toward further coöperating. They point out that the management of an orchard is a full-sized job and as long as the grower gets a fair return from his effort he is content to go forward on the existing basis. They argue that a few unsuccessful years might speed up the coöperative movement considerably. By some it is believed that further coöperation would increase the returns to the growers and promote the general welfare of the industry. Others are convinced as definitely that the opposite would be true. While the question carries economic aspects quite beyond the scope of the present study, its solution involves careful and constant recognition of the geographic relationships of which the industry as developed today is an expression (Fig. 28).

FIGURE 28.—The beauty and prosperity of the apple-growing district are sure to be reflected in the economic and social character of the community. Such fair vistas as these indicate that apple-growing in Nova Scotia is geographically and economically a sound industry. (Courtesy of the Canadian Pacific Railway.)

The first of these geographic relationships may be termed the *productive performance* of the industry. The present production has been attained only by long years of experience and experimentation, and represents the degree to which, through orchard management, the natural productive capacity of the

district is being utilized. In this respect the industry is well advanced and is advancing. The second is the *marketing performance*. In order to realize fully upon the productive capacity of the orchards, the market system should be adapted as effectively as possible to the job of placing a relatively perishable product, in good condition and at low cost, in an overseas market. Here the natural endowments consist of a definitely delimited district directly facing the North Atlantic Trade Route. The industry is developed in a peninsula province, the outlook of which is to the sea rather than to the continent. The position of this peninsula at the Atlantic apex of North America gives it an insular rather than a continental character. Its commercial structure is vitalized by its water routes to Britain and other oversea points rather than by its rail connections to the United States or interior Canada. Continentally its position as far as the apple industry is concerned is a liability, oceanically it constitutes an asset. The marketing aspect of the industry should be adapted to these fundamental geographic conditions. Whether this will be accomplished by a further development of coöperative marketing or by some system not yet over the horizon, remains to be seen.

ORIZABA—A COMMUNITY IN THE SIERRA MADRE ORIENTAL

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ORIZABA presents the striking phenomenon of a thriving city located in the midst of a barrier region. With its industrial suburbs, it contains approximately half of the 100,000 people living in a mountainous canton of 600 square miles. Its major industries are modern in scope, method, and organization, and their relations to each other and to the surrounding rural communities characterize the canton as a geographical unit of some complexity. Its population forms one of the more prosperous and stable social groups of Mexico.

In many respects Orizaba's situation is unusual. It is located in a mountain valley half-way up the steep Gulf slope of the Sierra Madre Oriental. Both from above and from below, it is approached through the deeply-dissected country adjacent to Mt. Orizaba, the highest peak between the Isthmus of Panama and the Canadian border. The habitable land of the district is restricted, and difficulties of communication are evidenced by the provincialism of villages located only a few miles from the railroad. In these, primitive customs persist, and the native tongue never has been replaced by the Spanish language.

In this rather unpromising situation has grown up a city of 50,000,[1] a city whose surroundings speak of the limitations of a mountain environment, but whose industries and outlook bear evidence of significant external contacts. Its narrow, crooked streets are paved with cobblestones and lighted by electricity. Its one-story, stone houses, with red-tile roofs, iron-barred windows, and whitewashed walls, stand side by side and extend their broad eaves over the sidewalks to protect pedestrians from the tropical sun or the tropical shower. Its numerous parks are bright with vegetation native to many climes, and the market place, by the variety of fruits and flowers displayed, suggests the proximity of contrasted environments. Mountains, many of which lift their summits to the approximate level of the Central Plateau, press close upon the city, their forested slopes forming the background for every view (Figs. 1 and 2). No smoke cloud obscures the landscape, yet in the city and its industrial suburbs busy factories are at work, their machinery propelled by the energy of Orizaba's streams.

Through the barrier of encircling mountains, fortunately, there is a way, and upon Orizaba's relation to this way have depended the growth of the city and the trend of its economic interests. As a division point and the seat of the railway shops, Orizaba contributes in an important way to the conduct of trade on the Mexican Railway; as a health resort it receives patronage from people at altitudes both below and above it; throughout its history it has served as the market center for a productive agricultural district; and as a manufacturing center it ranks high among Mexican industrial cities.

The Trade Route and the Railway

The Mexican Railway (Fig. 3), upon which Orizaba is situated, connects

[1] This includes the population of the factory suburbs. The figures from the 1910 census, as given in the *Boletin de la direccion general de estadistica*, No. 4, p. 37, are as follows:

Orizaba	35,263
Rio Blanco	6,148
Nogales	6,440
Santa Rosa	4,289
	52,140

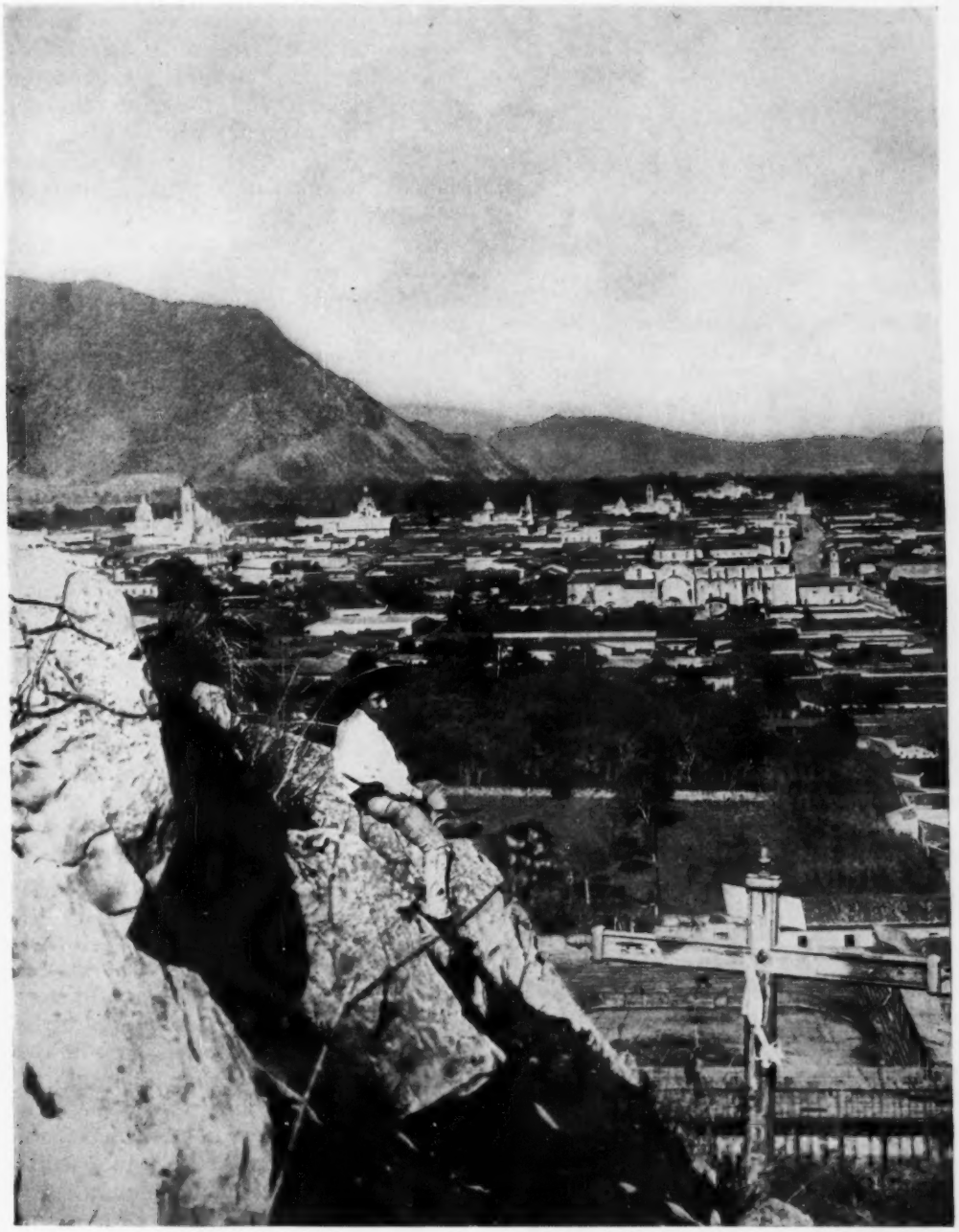

FIGURE 1.—Orizaba from the slope of the Cerro del Borrego, looking east towards the Cerro de Escamela, shown in the left background. The sky line is continued to the right by more distant mountains seen through the broad Escamela gap. In this gap is the east gate of the old city wall, located at the foot of the Cerro de Escamela. Farther to the right, but still within the gap, are the falls of Rincon Grande and Barrio Nuevo, beautiful scenic points and important power sites. (Photo by Underwood and Underwood.)

Mexico City with Veracruz. The railroad is standard gauge and has a solid roadbed. It has heavy steel rails, steel ties, and stone ballast throughout its entire length. In normal times there are two passenger trains daily, the night

FIGURE 2.—The Angostura gap, taken from a point near the jute mill, with the camera pointed west. In the Angostura gap, situated between the Cerro de San Cristobal (left background) and the Cerro del Borrego, is located the west gate of the old city wall, and through it pass the Rio Blanco, the Mexican Railway, the old National Highway, and the street car line which leads to the factory suburbs of Rio Blanco, Nogales, and Santa Rosa. The car track shown in the foreground is a continuation of the same line. The strategic importance of El Borrego with reference to the Angostura gap is suggested by the military road cut into its slope and showing in the picture as a faint line. (Photo by Underwood and Underwood.)

train having Pullman service. In addition to these, a mixed train runs daily between Veracruz and Orizaba, finding a considerable patronage among Veracruz people who, during the summer, spend the week-end in Orizaba, and among steamship passengers who wish to avoid spending a night in the port. It is the facility for communication afforded by this route which gives to Orizaba characteristics other than those of an isolated mountain community.

The route traversed by the Mexican Railway involves an ascent of 8,000 feet to reach the rim of the plateau, 80 miles from the coast, and it follows a course transverse to most of the drainage lines.[2] This railway is famous for the beautiful mountain scenery along its route, for the contrasted types of country through which it passes, and for the remarkable feats of engineering required in its construction. The road may be considered as made up of three sections, the coastal plain section, the mountain section, and the plateau section. The three sections differ in scenery and in the difficulties which were met by the road builders.

Across the coastal plain the railroad extends in a direct line to Paso del Macho, in the foothills, 47 miles from Veracruz and 1,587 feet above sea level. This portion of the route is characterized by gentle grades and by broad expanse of view, where the bordering plain is covered by barren dune sand or by riotous growths of tropical vines. The engineering problems of the coastal-plain section were comparatively simple, but the health conditions were poor and tropical fevers caused the loss of many lives.

The mountain section of sixty miles extends from Paso del Macho to Boca del Monte. It is characterized by magnificent scenery and by daring feats of engineering. Numerous bridges and viaducts carry the road across young mountain valleys, tunnels pierce the divides, steep grades and sharp curves are common, and in places the roadway is cut into an almost vertical canyon wall. Between Orizaba and Maltrata is a deep and narrow gorge to which dangers and accidents gave the name of *El Infiernillo*. Great masses of rock had to be removed to make room for the track. So narrow and insecure was the footing that the workmen suspended themselves from the trees by means of ropes, while water and construction materials had to be brought up the steep trails on the backs of donkeys.[3] When the west-bound train reaches Orizaba after a four-hour journey from Veracruz, it has climbed to an altitude equal to half that of the Central Plateau. The ascent of the remaining 4,000 feet is made in about eighteen miles of horizontal distance. For this section of the road, before the recent installation of electric power, giant double-

[2] Mexican Railway folder.

[3] Baz and Gallo, History of the Mexican Railway, pp. 128–129.

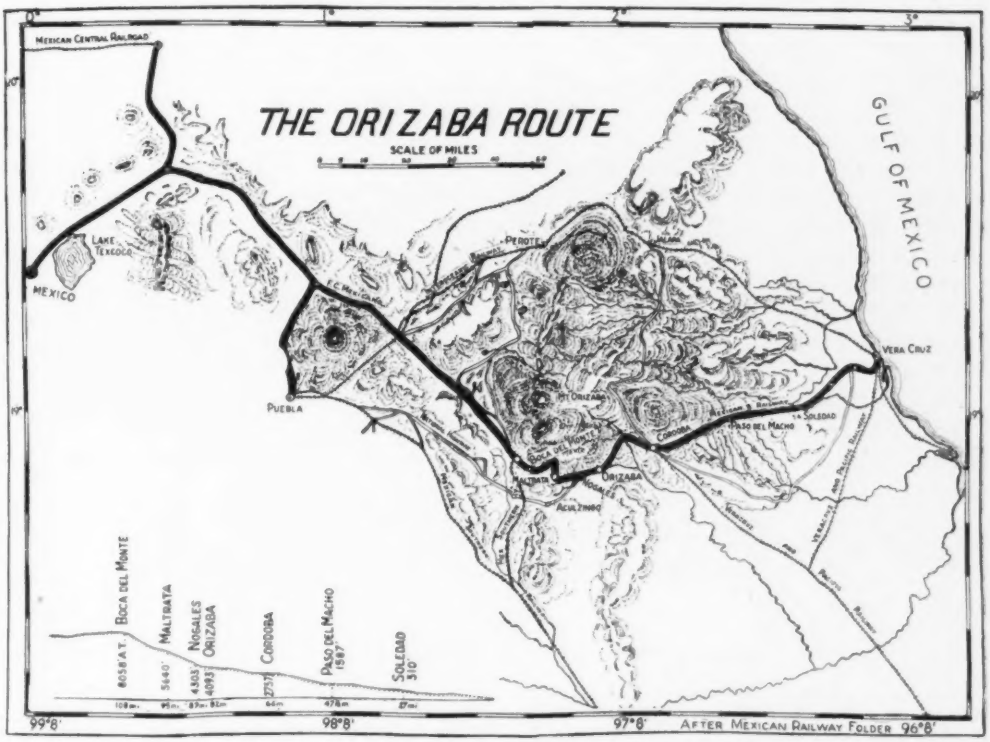

FIGURE 3.—The Orizaba route is followed by the Mexican Railway from Veracruz to Mexico City, while the rival Jalapa route is indicated by the course of the Interoceanic. The Mexican Railway is standard gauge, and Pullman service is provided on the night trains. The Interoceanic is narrow gauge. South of the Mexican Railway the map indicates two of the major ridges of the Sierra Madre Oriental, these ridges disappearing to the north beneath the volcanic group.

header engines were used on account of the steep grades and sharp curves. Between Maltrata and Boca del Monte, distant from each other about four miles horizontally, the road makes an ascent of 2,400 feet by a circuitous route of 13½ miles within a small valley known as La Bota. Passengers on the westbound train, after coming out of the valley of La Bota, may look down upon the village of Maltrata, which they left some forty-five minutes before. They have another unique experience, for the same vendors who, in the sub-tropical valley of Maltrata, offered fruits and orchids at the car windows are waiting for the train at Boca del Monte, where the slopes are covered with coniferous forests. During the six-hour journey from the palm-fringed shores of Veracruz to the pine-clad rim of the Central Plateau, vegetational changes representing climatic contrasts have come with striking rapidity, but the climax in abruptness of transition is pointed out by the 45-minute climb of the Maltrata natives.

The break in scenery is sharp between the mountain and plateau sections of the road. A few miles beyond Boca del Monte a slight descent is made to the first of the filled lake basins which make up the Central Plateau. The ascent of a few hundred feet made in crossing the divides which separate the basins is scarcely perceptible. Monotony of surface is broken by isolated mountain ranges which rise abruptly from the surrounding level, and in one part of the route three snow-capped peaks are in sight. Tropical vegetation is absent, and even the coniferous forests are left behind. There is a general aspect of aridity, and at certain stations the pau-

city of building material is suggested by the sight of huts constructed of discarded wooden railroad ties and enclosed by hedges of giant cactus. Fields of wheat or barley cover the lake plains where moisture conditions are favorable, and maguey plantations extend even to the tops of some of the minor ranges (Fig. 4). Difficulties of engineering and dangers to life were not great in the building of the plateau section of the road, but construction materials had to be brought up the steep mountain roads by pack trains or transported hundreds of miles across the semi-desert Northern Basins from the American border.

FIGURE 4.—A maguey hacienda on the Central Plateau near Mexico City. Maguey cultivation, as shown in the picture, is not limited to the level surface of the filled lake basins which make up the Central Plateau, but extends to the summits of some of the minor ranges. This view is typical of scenery along the plateau section of the Mexican Railway. (Photo by Underwood and Underwood.)

The importance of the route which passes through Orizaba is indicated by the fact that the Mexican Railway was the first railroad built in Mexico, although it cost $40,000,000 for less than 300 miles [4] and exacted an enormous toll in human lives. The number of deaths from coastal fevers on the lowland and from casualties in the mountain section was so great as to give rise to the saying in Mexico that the railroad cost a life for every tie. The undertaking was justified by the volume of trade between Mexico City and Veracruz and by the superiority of the Orizaba route over competing routes. Mexico City and Veracruz have occupied dominating positions throughout the commercial history of the country. The foreign commerce of the densely-peopled Central Plateau is largely Atlantic trade, passing through the port of Veracruz; and apparently the supremacy of Mexico City as the commercial center of the country never has been questioned. Long before the coming of Europeans the commerce of the country had centered in the Valley of Mexico, from which radiating routes (Fig. 5) lead to both coasts and across the basin region to the north. Here was

[4] Bancroft: *History of Mexico*, Vol. VI, p. 555, note 67.

the capital from which the Montezumas ruled their subject states, and to which the tribute of the empire was carried. The Aztec capital was the goal of Cortez and his army, and with the establishment of Spanish rule it not only maintained its political leadership but gained added commercial importance because of its share in the extensive trade between the mother country and the new colony. By 1581 "Mexico was . . . the center for traders from Asia, America, and Europe, and the harbors of Veracruz and Acapulco had become famous in the trafficking world."[5] Practically all the trade between Spain and Mexico passed through the port of Veracruz, and the merchandise was transported to the interior by pack trains.

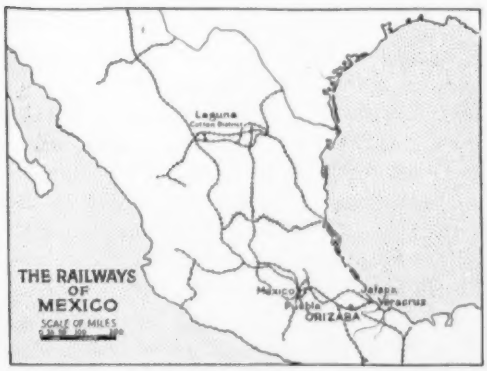

FIGURE 5.—Mexico City is the principal railway center of the Republic. Centrally placed within the most densely populated region of Mexico, and situated near the principal hydrographic center, its location justifies its position as the commercial capital of the country.

FIGURE 6.—Sketch map of Orizaba canton. The canton is made up of a group of converging valleys lying at the foot of Mt. Orizaba. The roads and trails which lead by valley routes to the agricultural villages and estates indicate the position of the city as the economic center of the district.

Communication between Veracruz and the Valley of Mexico is limited to a few routes because of the intervening dissected mountain country and the great volcanic mass of Mt. Orizaba piled upon the margin of the plateau. Spanish commerce followed the two routes which had been found feasible by Aztec traffic. One of these routes avoids the volcanic group by passing to the south through Orizaba and Cordoba, while the other skirts the northern flank of the volcanoes and passes through Perote and Jalapa (Fig. 3). Each route has its advantages, and both have continued in use to the present. The superiority of the southern route was demonstrated, however, by the surveys which preceded the construction of the Mexican Railway. Beginning in the 1830's, repeated attempts were made to secure the building of a railway to connect the capital city with the chief Gulf port. These attempts took the form of both direct government participation and the granting of concessions. By 1857, however, only a few miles of road had been constructed. In that year Don Antonio Escandon, a resident of Orizaba, secured the concession under which the road was built. Both the Orizaba and Jalapa routes were surveyed, and the former was chosen on the basis of both construction cost and prospective traffic. It passed through a more productive area with a larger number of important towns, while the bedrock was less expensive to work and at the same time more stable. Moreover, the Jalapa route, although the grades are less steep, crosses a greater number of ravines.[6] The advantage of the Orizaba route is explained, doubtless, by the fact that it crosses the Eastern Sierra Madre almost entirely within a limestone area,

[5] Bancroft, *op. cit.*, Vol. II, p. 753.

[6] Baz and Gallo, *op. cit.*, p. 14.

while the Jalapa route is bordered, throughout much of its length, by recent lava flows.[7] In 1864 the concession was taken over by the Imperial Mexican Railway Company, a British concern, and the road was opened to traffic January 1, 1873.[8]

The strategy of Orizaba's position on the route from Veracruz to Mexico is recognized in the organization of the railway administration, for upon the completion of the road, Orizaba was made a division point, and to it were removed the railway shops, which, during the construction period, had been located at Veracruz and Mexico City. This was a logical change, because of Orizaba's relation to contrasted portions of the line, its situation being particularly significant with reference to the stretch of mountain road above it, where special engines were used. In addition to the advantages of position, the abundant water supply and healthful climate of Orizaba influenced the location of the shops, which employ 800 men, and which carry on repair work sufficiently extensive to rank them definitely among manufacturing establishments. Its designation as a division point, together with its climatic advantages, explains the selection of Orizaba as a place of residence by many other employees of the road. Thus, its function as a link in the transportation system of Mexico adds considerably to the population of Orizaba.

The advantages of the immediate site of Orizaba made themselves felt at a very early date, for it was these advantages which led to the founding of the Spanish village which grew into the modern city. So far as European settlement is concerned, Orizaba began its history as a way-station on the southern route between Veracruz and the Valley of Mexico in the early days of the Spanish occupation. The length and difficulty of the routes made necessary a resting place for man and beast somewhere on the way, and on the southern route the valley of Orizaba offered many attractions. When this valley is reached, although less than a third of the distance to the capital has been covered, half the total ascent has been made. The climate is free from the discomforts of both the coastal plain and the Central Plateau. There was abundant pasturage for the pack animals and a plentiful supply of water.[9] Moreover, it was possible to procure supplies from the inhabitants of the valley, who were engaged in agriculture.[10] The pack trains remained in the valley for three or four days, and in the rainy season they frequently remained for a month or more.[11] This practice made necessary the erection of cabins for shelter and of corrals for the pack animals. Before long, certain traders, recognizing the opportunity for a lucrative business in the trading of pack animals, settled permanently in the valley.[12] This little group of traders furnished the nucleus of the Spanish village. In the activities of the early village were foreshadowed the leading functions of the modern city. The station soon gained recognition as a health resort, it was the market center for a productive agricultural district, and early in its history the use of water power for manufacturing was inaugurated.

ORIZABA AS A HEALTH RESORT

The proximity of Orizaba to the coastal lowlands, its healthful climate, and its frequent communication with the Gulf port made the new village a convenient resort for victims of coastal fevers. The number of these transients seems to have been considerable, but no special provision for their care was made until 1619, when the hospital of San Juan de Dios was founded.[13] Orizaba's reputation as a health resort still is a rather important commercial asset and is

[7] *Boletin del Instituto Geologico de Mexico*, Nos. 4, 5, y 6, p. 165 and geological map at end of volume.

[8] Baz and Gallo, *op. cit.*, p. 16

[9] Naredo: *Orizaba*, Vol. I, Book II, pp. 38–39.

[10] *Ibid.*, p. 24.

[11] Perez Milicua, Luis: *Veracruz, Resena Geografica y Estadistica*, p. 81. (Perez Milicua quotes Arroniz, a local historian.)

[12] Baz and Gallo, *op. cit.*, p. 116.

[13] Naredo, *op. cit.*, Vol. II, pp. 81–82.

responsible for a considerable addition to the number of inhabitants during the summer months. In addition to invalids and convalescents, the city annually accommodates many wealthy families who desire to escape the oppressive heat of *tierra caliente*. Its proximity to the tableland and its moderate elevation enable it to draw, to a lesser extent, invalids and convalescents from the Central Plateau. Thus, as a health resort, Orizaba profits from its intermediate altitudinal position between the Eastern Tierra Caliente and the Central Plateau.

ORIZABA AS A MARKET PLACE

Orizaba's prominence as the market center for a rich agricultural district was, until recently, its chief distinction; and this phase of its economic life still is important, although manufacturing interests now hold first place. The location of the city with reference to the arable land of the district and to the principal trade route makes it the logical business center for the rural communities of the canton. The canton is, in fact, a clearly defined natural division whose boundaries are barriers enclosing a group of converging valleys with the city at their focus. The arrangement of the roads which radiate to the rural villages and estates, as shown on the map of the canton (Fig. 6), testifies to the position of the city as the commercial center of the district. The agriculture of the district is largely commercial, and very largely it is specialized in type and concerned with supplying the needs of the city population. It is characterized by wide variety, ranging from tropical fruits unknown in northern markets to crops such as are grown on Kansas farms. Orizaba people are supplied with perishable foods by market gardeners in the outskirts of the city, and even the more remote rural villages are producing fruits, vegetables, poultry, and eggs for the city market.

Agricultural production in the Orizaba canton is large per unit area. This statement is supported by the density of the rural population, which, according to the 1910 census, was 84 per square mile for the whole canton, although probably less than one-fourth of the total area can be cultivated. A high degree of productivity is indicated also by the size of the land holdings. Although the area of the canton is no greater than that of many a single hacienda in the semi-desert Northern Basin Region, it contains nearly 40 agricultural estates and more than a dozen rural villages, while the largest haciendas comprise only 5,000 to 8,000 acres,[14] including timber land on slopes too steep for cultivation. High rank in productivity long has characterized the canton, and in 1873, before large-scale manufacture had begun in Orizaba, with its marked stimulus to specialized agriculture, the annual value of products of the soil was estimated at a half million dollars.[15]

The amount of arable land and the soil fertility are explained in part by the mountain structure. The Sierra Madre Oriental is made up chiefly of compact limestone, complex in structure, but having a general southwesterly dip.[16] In harmony with this structure, there have been developed a series of indistinct ridges, which disappear to the north beneath the igneous mass of Mt. Orizaba. Between two of these ridges, represented by the Cerro del Borrego on the west and the Cerro de Escamela on the east (Figs. 1, 2, and 7), the broad strike valley of the Rio Orizaba (Fig. 8) extends to the foot of the snow-capped peak. The Rio Blanco, the trunk stream of the district, rising some twenty miles southwest of Orizaba in the mountains which form the rim of the Central Plateau, maintains a direction transverse to the strike, with the strata dipping upstream at high angles. Where it has cut through the ridges bordering the Orizaba Valley, its valley is constricted, forming the two

[14] This statement applies to conditions before agrarian changes of the revolutionary period were made. Based on Naredo, *op. cit.*, and statement from Orizaba Chamber of Commerce.

[15] Baz and Gallo: *History of the Mexican Railway*, p. 120.

[16] Bose: "Geol. de Orizaba," *Bol. Inst. Geol. de Mex.*, Num.13 (1899).

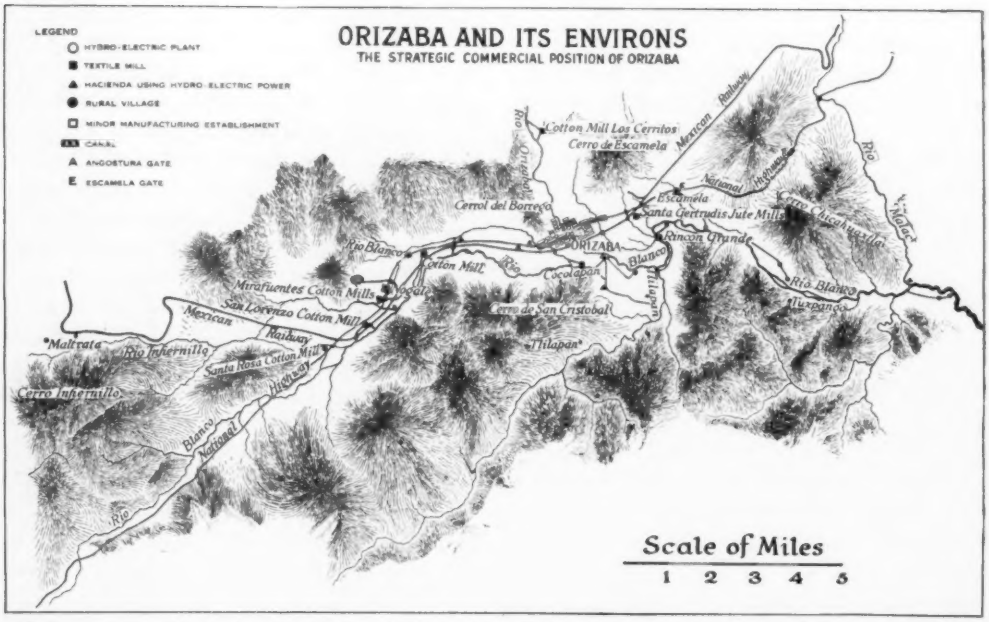

FIGURE 7.—Orizaba is situated at the junction of the Rio Orizaba and the Rio Blanco valleys, 4,000 feet above sea level. The neighboring mountains rise to heights from 1,300 to 3,000 feet above the valley level. Agriculture, to a great extent, is limited to the valley bottoms, for most of the mountain slopes are too steep even for pasture. The manufacturing industries of the district are carried on through the utilization of notable water-power resources. The major sites are within the canyon belt extending from Escamela to Tuxpango, and the power is conducted electrically to the mills located several miles to the west, in the open valleys. Power in lesser volume is developed from the Rio Blanco and its tributaries at minor sites near the mills. (The map is compiled from data furnished by S. W. Stacpoole, formerly consulting engineer in Orizaba.)

narrows in which are situated the western and eastern gates of the old city wall, the Angostura and Escamela gates respectively. To the south of the Rio Blanco, the strike valley is continued and is occupied by the Rio Tlilapan. The crossing of the valleys is the focal center of the canton and the site of Orizaba. There, a broad stretch of comparatively level land gives space for the location of the city and for the arable acreage of several of the larger estates; but the existence of this significant level is due to the difficulties experienced by the Rio Blanco in escaping through the Escamela gap. There the river encounters the upturned edges of heavy-bedded and resistant slates, which interrupt its course at the beautiful falls of Rincon Grande.[17] The Escamela barrier has checked downward erosion above the falls, and, consequently, the Rio Blanco and its tributaries flow in open valleys which are floored with alluvium derived largely from the neighboring limestone hills. The possession of these broad valleys is the agricultural opportunity of the Orizaba canton, and within the valleys are located most of the agricultural villages and estates.

The value of the agricultural land of Orizaba is enhanced by its altitudinal position and its exposure to rain-bearing winds. The 4,000-foot elevation of the city places it below the frost line, while the long tongue of land bordering the Rio Blanco on the right extends down into the zone of *tierra caliente*. The rainfall is more than 100 inches,[18] with a summer maximum and a comparatively dry season of only about three months.

[17] Bose: "Geologia de los alrededores de Orizaba," in *Bol. del Inst. Geol. de Mexico*, Num. 13, p. 20.

[18] Hann: *Klimatologie*, Vol. II, p. 325.

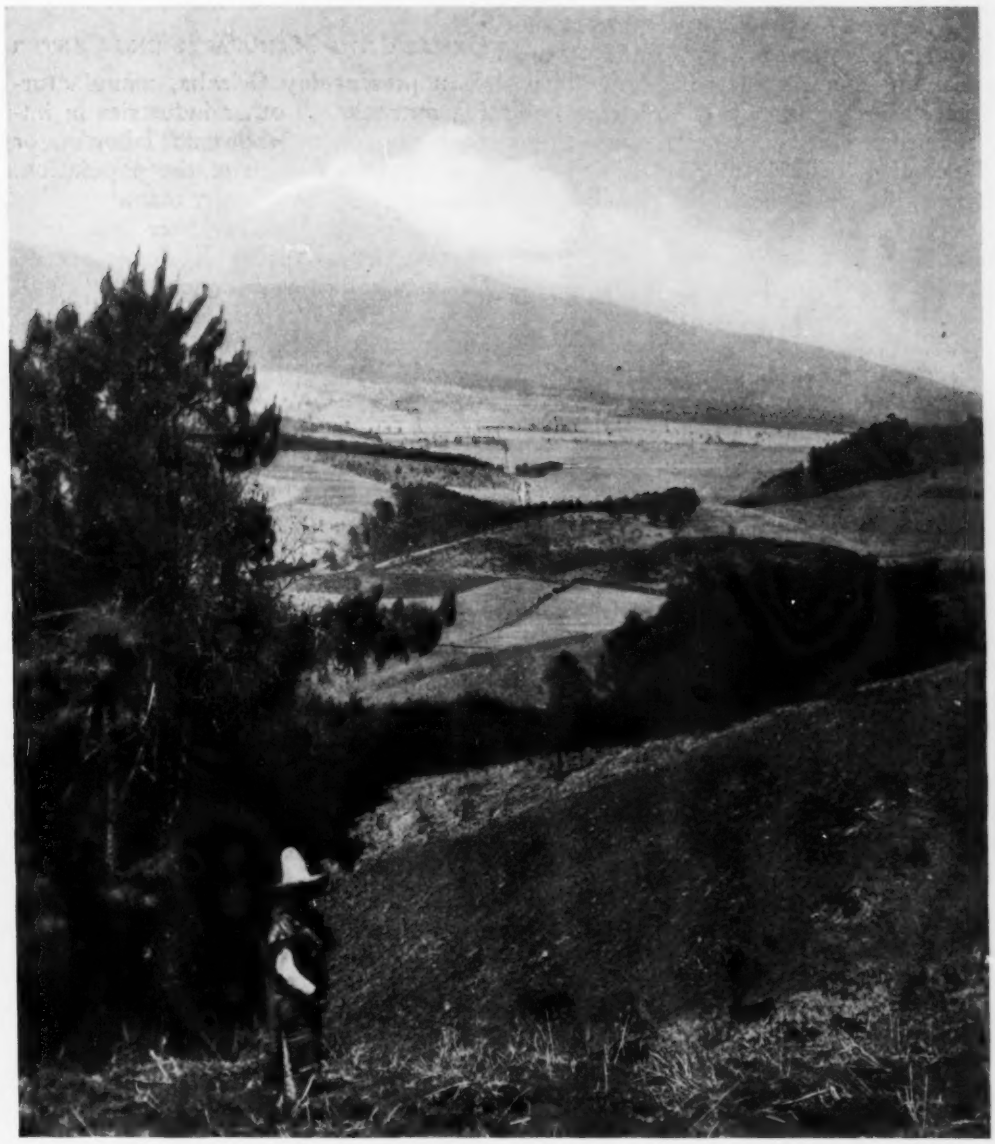

FIGURE 8.—Agricultural land in the valley of the Rio Orizaba above the city. This broad and fertile valley extends to the foot of snow-capped Mt. Orizaba, which is seen in the background. The junction of this valley with that of the Rio Blanco gives Orizaba a strategic location which makes it the market center for the canton. (Photo by Underwood and Underwood.)

This lower portion of the canton is within the zone of sugar and coffee culture, and these crops are important on the larger land holdings. The mountains, some of which have summit areas large enough to be farmed, extend well up into the frost zone, as do the valleys in the western part of the canton. These cooler portions are capable of producing apples, wheat and barley, beans, and other crops of middle latitudes. The production of corn, the staple food cereal of the common people, is distributed throughout the canton.

The type of agriculture in the Orizaba district has varied from time to time in accordance with progress in commercial intercourse with the outside world,

and as these changes have taken place the relation of the market center to the rural communities has been modified. The soil resources of the district had been utilized for many generations before the coming of the Spaniards. This early agriculture can scarcely have been commercial, although the payment of an annual grain tribute to the Moctezuma empire may be considered as a form of export. With the establishment of the Spanish village in response to the requirements of the newly-inaugurated trans-Atlantic trade, the agriculture of the native inhabitants was stimulated. The pack trains replenished their supplies, and new crops were introduced, which found their market among the European settlers on the coastal lowlands. Under the viceroys, agriculture for overseas export absorbed the attention of the farming population. Tobacco culture was a government monopoly, limited to the two districts of Orizaba and Cordoba. The location of these districts on a main-traveled route facilitated both the export of the crop and the regulation of the industry,[19] while their limey soil gave them preference over other places favorably located with reference to trade routes. "Factories" for curing, packing, and storing tobacco were established at Orizaba, as one of the two shipping points. The profits and attractions of commercial production were so great that constant vigilance was necessary to enforce government restrictions. The volume of the tobacco trade must have been great, for in 1825, when production had declined greatly, the crop of the Orizaba canton is said to have been valued at $1,300,000.[20] At present, with the exception of coffee, there is practically no crop grown for export. Sugar is marketed beyond the limits of the canton, but Orizaba furnishes a nearby consuming market which requires practically the whole surplus from the farms of the canton.

[19] Naredo, *op. cit.*, Vol. I, Book II, p. 52.

[20] Naredo, *op. cit.*, Vol. I, Book II, p. 53; Vol. II, pp. 15, 17.

ORIZABA AS A MANUFACTURING CENTER

In present-day Orizaba, manufacturing outranks all other industries in importance. Nine thousand laborers, or more than one-sixth of the population, are employed in the larger manufacturing establishments, while lesser industries engage the attention of many others. Orizaba ranks high among the small group of Mexican manufacturing cities, and as a cotton-manufacturing center it holds first place.

No other Mexican city approaches Orizaba in the importance of its cotton manufactures. The principal mills (Fig. 9), each containing 40,000 to 50,000 spindles and employing 1,500 to 2,000 laborers, are the largest and best equipped in the Republic and are comparable in size to a medium-sized New England

FIGURE 9.—The Rio Blanco Cotton Mill is the largest cotton factory in Mexico. Besides the spinning and weaving departments, it contains the warehouses of the Compania Industrial de Orizaba. It also contains the equipment of the company for waste-spinning, dyeing, bleaching, and mercerizing. Its finishing plant includes machines for napping, back-starching, tentering, and beetling, and it has ten 8-color printing machines. The buildings in the foreground are residences for employees. (Photo by Williams Bros.)

mill.[21] Together, the six Orizaba cotton factories contain more than one-fifth of the total cotton spindleage of Mex-

[21] Clarke: "Cotton Goods in Latin America," *U. S. Dept. of Com. and Labor, Special Agent Series*, No. 31, p. 21; Copeland: *The Cotton Manufacturing Industry in the United States*, pp. 141–142; and statements from manufactures.

ico,[22] and the value of their output, as measured by the distribution of the Federal sales tax on cotton mills, is more than one-fourth that of the entire Republic and more than double that of the thirty mills located in Puebla, the nearest Mexican competitor.[23] The equipment of the mills is modern in every respect, the machinery is of British manufacture, the work is supervised by men trained in the Manchester district of England, and the higher-grade goods produced are the finest made in Mexico. Wide variety characterizes the output, which ranges from heavy suitings to fine ginghams, dimities, and other dress goods with fancy weave. The mills are equipped for the entire sequence of manufacturing processes, including dyeing, printing, and mercerizing.

Although Orizaba is primarily a cotton-manufacturing center, there are several other factories of considerable importance. Of these the Santa Gertrudis Jute Mill (Fig. 10), using 2,000 horse power and employing 1,300 laborers, is the largest. Raw jute is obtained from India, and the finished products are consumed in the Mexican market. The output of bags and packing cloth is significant in Mexican economic life, since these articles facilitate the marketing of grain, raw cotton, coffee, and ore, thus furthering the interests of agriculture and mining, the principal economic activities of the Republic. Orizaba is one of the larger brewing centers of Mexico and one of the more important producers of cigars. In number of men employed, the Mexican Railway shops rank next to the textile industries. Associated with and supplementary to these principal industries are many smaller establishments which manufacture clothing, food products, and other commodities for local use.

Orizaba's industrial development is a logical outgrowth of its agricultural history. Manufacturing is not a sudden change imposed without warning by demands of other lands. Instead, it has developed by successive stages from primitive beginnings in prehistoric times, the modern stage having come in with the establishment of improved world communication, and having been accomplished through the utilization of notable power resources furnished by the Rio Blanco and its tributaries. Not only is the power afforded by these streams great enough to propel the machinery of the Orizaba factories, but, in addition, commercial power is sold throughout a territory including Veracruz on the one hand and eleven or more plateau cities on the other. Within the last few years additional power has been developed to run the trains on the steep mountain section of the Mexican Railway.

Surface, climate, and structure combine to bring about this remarkable con-

FIGURE 10.—Interior of weaving room in Santa Gertrudis Jute Mill. The mill has a capacity of 5,000 tons of raw jute annually, and its output consists of shipping bags, packing cloth, rugs, carpets, and twine. The work is supervised by men trained in the Dundee mills of Scotland. (Photo by Underwood and Underwood.)

[22] Holaday: "The World's Cotton Spindles," in *Commerce Reports*, Oct. 16, 1920, p. 252, and statements of manufacturers.

[23] Based on unpublished tax list furnished by U. S. Bur. For. and Dom. Com. (File 10015).

centration of power. The Rio Blanco has a comparatively small drainage basin, but that basin is situated in a region of high relief, abundant rainfall, and complex structure. The average slope of the surface from the rim of the Central Plateau to the Gulf coast is 100 feet per mile, but the slope in the vicinity of Orizaba is steeper. From Aculzingo, near the source of the Rio Blanco, the surface descends at an average rate of 150 feet per mile to Orizaba, while the average slope from Orizaba to Tuxpango is 250 feet per mile.[24] The annual precipitation, as previously noted, is more than 100 inches. While there is a well-marked summer maximum, the effect of seasonal distribution on stream flow is counteracted in part by the frequency of long-continued drizzly rains in winter, by the presence of a forest cover on the mountain slopes, by the prevalence of solution channels in the rock, and by the drainage from the permanent snow fields on the upper slopes of Mt. Orizaba. The structural barrier encountered by the Rio Blanco in the Escamela gap results in a notable concentration of power. Due to the complex structure and the prevalence of faults, the same resistant strata are met again and again, resulting in a series of falls. At Tuxpango, five miles below the city, the Rio Blanco, its volume tripled by the half-dozen tributaries which join it above the barrier, has reached a level 1,300 feet below that of the city. The hydroelectric plants which mark the various steps in its descent were furnishing, in 1921, more than 27,000 horse power, and considerable additions have been made since that time.[25] The tributaries of the Rio Blanco, small streams, whose bowlder-strewn beds indicate their steep gradients, furnish a large number of minor powers, widely distributed throughout the district. At these minor sites, power is obtained for many small mills and for the manufacture of sugar on the principal haciendas. The total amount of power available in the district was estimated in 1921 at 100,000 horse power, of which approximately half has been developed.[26]

While large-scale use of water power in Orizaba is a recent development, its origin can be traced to the early history of the community. The Spanish village was not many years old when a beginning was made in harnessing the water power of the district for manufacture. The innovation was related closely to agriculture and to the through trade. At some time before 1555 a flour mill had been erected at one of the numerous minor power sites of the district.[27] Flour-milling continued to be important until about the end of the nineteenth century. Wheat was grown, not only on the plateau as at present, but also in the more elevated and less humid valleys of the Orizaba canton, notably, near Maltrata and Aculzingo. The principal market for the flour was furnished by the Spanish inhabitants of the coastal lowlands.[28] It is probable, however, that some of the Orizaba flour was exported, for Humboldt, writing in the early part of the nineteenth century, said, "The Mexican flour enters into competition at Havannah with that of the United States."[29] Thus, in the first stage of its industrial development Orizaba profited by its intermediate position between the wheat-growing upland areas and the wheat-consuming coastal lowlands of Mexico and the West Indies.

The making of cotton cloth in the Orizaba Valley antedated the coming of the Spaniards, probably by several hundred years, and this line of manufacture also was related to the agricultural activities of the inhabitants. Legend says that the Toltecs, who established themselves on the Central Plateau about 667 A.D., brought with them from their old home somewhere to the northeast of New

[24] Based on data from Baz and Gallo, *op. cit.*, p. 127, from Mexican Railway folder, and from unpublished map by S. W. Stacpoole.

[25] Data from Naredo, *op. cit.*, and from statements by S. W. Stacpoole and E. Mayer.

[26] Estimate by S. W. Stacpoole.

[27] Naredo, *op. cit.*, Vol. I, Book II, p. 41.

[28] *Idem.*; also Baz and Gallo, *op. cit.*, p. 122.

[29] Humboldt: *Political Essays on the Kingdom of New Spain*, Vol. II, p. 336.

Mexico, the seed of the cotton plant.[30] Inter-tribal wars led to the discovery of the attractive valleys lying at the foot of Mt. Orizaba, and settlements were made at various points, among them Orizaba and Maltrata.[31] Doubtless, the pioneers brought with them the textile art. At any rate, after its defeat by the armies of Moctezuma in 1457 the community was required to pay to the Aztec empire an annual tribute of cotton cloth.[32]

The manufacture of cotton as a household industry continued after Spanish settlement, and by the beginning of the nineteenth century the industry had become to a considerable extent commercial, the growing, spinning, and weaving of the fiber being carried on by different groups of people, for whom the cotton industry appears to have been the chief source of cash income.[33] Of the change which brought into being the next stage in development, a local historian writes as follows: "But all this industry, which had given rise to so much commercial activity, and which had furnished occupation for many hands, received its death blow with the opening of the Cocolapan cotton textile mill."[34] The mill of which the historian speaks, erected in 1836 near the southern border of the city (Fig. 7), was the first to utilize Orizaba water power for cotton manufacture. The new industry of cotton spinning was a logical outgrowth of local conditions. Power of the kind then in general use was abundant. Cotton, still regarded as something of a luxury in England and the United States at that time, was the fabric ordinarily used for clothing in Mexico. The fiber was produced in the surrounding district, and the native race had been trained for many generations in the fundamental processes involved in its manufacture. Thus the new mill was assured a local supply of raw material, a market for its finished product, and a supply of skilled labor.

The establishment of the Cocolapan mill at this time was a particularly fortunate event in the economic history of the city, for it helped to bridge over a gap in the progress of Orizaba's way-station business. Rivalry between the Orizaba and Jalapa (Fig. 11) routes had reached one of the crises by which it was characterized. This rivalry had existed almost from the founding of the two towns and had increased in bitterness with every triumph of either route. About the end of the eighteenth century there was a demand for an improved road to connect Mexico City with Veracruz, and the towns along the rival routes presented their respective claims. It so happened that the construction of both roads was started but neither had been finished when, in 1810, the War for Independence interrupted work on internal improvements. The Orizaba road, beginning at Mexico City, had been finished through Puebla, Orizaba, and Cordoba to within fifty or sixty miles of the coast. For its completion there were lacking the construction of a short but difficult mountain section, the bridging of several streams commonly much swollen in the rainy season, and the crossing of the swampy border of the coastal plain. The other road, starting at Veracruz, had been built through Jalapa to Perote, on the border of the tableland. Consequently, it was a comparatively simple matter, when hostilities ceased, to extend this latter road across the plateau to Puebla, where connections were made with the unfinished Orizaba road.[35] By 1833 a line of stage coaches was running on the Jalapa highway,[36] and not until 1855 was the completion of the southern route accomplished and Orizaba's share in the way-station business restored. In spite of its misfortune, however, Orizaba continued to prosper, for the new industry of machine spinning gave increased economic opportunity, and within five

[30] Clavigero: *Historia Antigua de Mexico*, Vol. I, pp. 79–80.
[31] Naredo, *op. cit.*, Vol. I, Book II, pp. 14–18.
[32] Naredo, *op. cit.*, Vol. I, Book II, pp. 24, 30.
[33] *Ibid.*, p. 16.
[34] *Idem.*
[35] Naredo, *op. cit.*, Vol. I, Book I, pp. 26–33.
[36] Perez Milicua, *op. cit.*, p. 82.

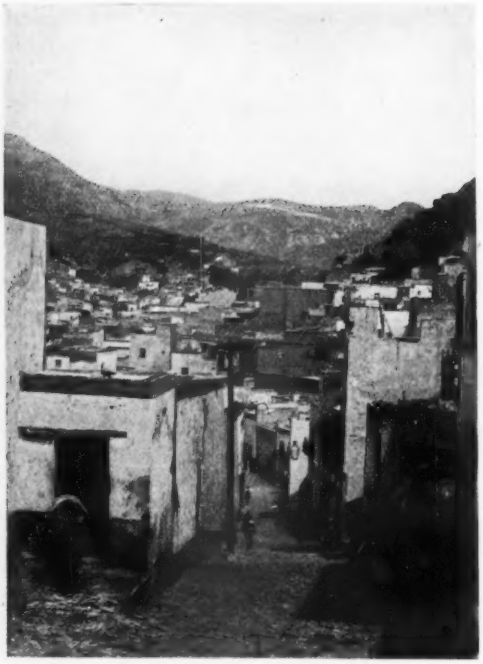

FIGURE 11.—The city of Jalapa is Orizaba's rival because of its location on a competing route. Political rivalry has grown out of economic competition, and Orizaba people resent the location of the state capital at Jalapa. The great disadvantage of Jalapa is its location in an area of recent lava flows, the nature of which is unfavorable for railroad building and makes the agricultural land of relatively low value. (Photo by Underwood and Underwood.)

years after the opening of the mill the population had increased from 17,000 to 24,000.[37]

The modern stage of industrial development in Orizaba awaited the establishment of railway communications. The modern mills, with a capacity of 15 or 16 million pounds of raw cotton annually, could not be supplied by local production alone. In fact, since railway transportation has made practicable the purchase of bulky commodities in world markets, cotton-growing has been discontinued in the Orizaba district. With the exception of about 100,000 pounds of Egyptian cotton, the fiber is obtained either from the United States or from the Laguna district of northern Mexico (Fig. 5), where cotton is grown under irrigation. Railway lines, radiating from Mexico City, give access to both the Mexican and Texan cotton-growing areas, while in normal times Veracruz has steamship connections with American cotton ports, in addition to regular trans-Atlantic service. The increasing railway net is an important factor also in the distribution of the finished product. The Orizaba mills, producing a higher grade of goods than those produced by competitors in Mexico, are cultivating the trade of the Capital and other Mexican cities, with no attempt to sell into other Latin-American countries, where they would be obliged to compete without the advantage of a protective tariff. Their marketing headquarters are located, very advantageously, in Mexico City, which is the great wholesale center of the country, and where much of the capital stock is held by French wholesale dry-goods merchants. Thus, from the principal railroad center, and from what are practically the companies' own stores, the Orizaba cottons are distributed throughout the Republic.

The new era of cotton manufacture has been characterized by repeated expansion. Political unrest delayed development for a few years after the opening of the Mexican Railway in 1873. About 1880 there began a period of comparative quiet, and government policy favored the investment of foreign capital for the purpose of developing the country's resources. The cotton mills of San Lorenzo and Los Cerritos, erected in 1882 at minor power sites (Fig. 7), were rather small concerns at first, the number of operatives employed in each being estimated at 300 in 1898.[38] A step towards the enlargement of the plants and the centralization of ownership was taken in 1889. In that year the Compania Industrial de Orizaba was organized to acquire and operate the mills of San Lorenzo and Los Cerritos and to erect a new mill, which was to be of large size and equipped with the most modern machinery. This new mill (Fig.

[37] Baz and Gallo, *op. cit.*, p. 119.

[38] Naredo, *op. cit.*, Vol. II, p. 250.

9), which was called the Rio Blanco from the name of the river supplying it with power, contained, at the start, 35,000 spindles, 900 looms, and six printing machines. The power was supplied by five turbines aggregating 1,580 horse power. In 1889 the company purchased the old Cocolapan mill, chiefly for the purpose of securing the valuable water power belonging to the property.[39] The old mill was enlarged, fitted with modern machinery, and reopened about the middle of the decade 1900–1910. Thus the Compania Industrial de Orizaba now operates all the Orizaba cotton mills except the Santa Rosa factory and the small spinning mill known as Mirafuentes.

The latest stage in the evolution of Orizaba as a manufacturing center was ushered in by the perfection of methods for the long-distance transmission of electricity. With this new development of science, it became possible to utilize the large powers located in the canyon belt from the Escamela gap to Tuxpango. The pioneer in this enterprise was the Santa Gertrudis Jute Mill Company, which, in 1892, acquired water rights on the Rio Blanco and constructed the first hydro-electric plant in the Escamela gap, deriving power from the Falls of Barrio Nuevo (Fig. 12). The Santa Gertrudis mill was the first jute mill erected in Mexico and the first mill of any kind in the Republic to be run electrically.[40] Electric power generated in the Escamela gap now is transmitted several miles to the cotton mills, whose location was determined in the period of direct power, and which still continue to utilize local powers. The expansion in cotton manufacturing justified by the increased amount of power available has been accomplished through the enlargement of existing mills and not by the building of new factories. Electrical power is not restricted to those companies which have their own generating plants. The factories of secondary rank, and even some of the small and primitive mills, purchase power from some one of the commercial companies, which distribute power, as already noted, both in Orizaba and in neighboring cities and regions.

FIGURE 12.—The Falls of Barrio Nuevo, 100 feet high, supply power for the Santa Gertrudis Jute Mill. The power house in its former position, huddled against the almost vertical left wall of the canyon, at the foot of the falls, was reached by a long flight of wooden steps. In order to obtain additional power, the plant was removed to a point about one kilometer down stream. (Photo by Underwood and Underwood.)

The growth of Orizaba's industries has been attained by a series of adjustments, each showing a changed relation to world commerce. Beginning with a small group of people whose labor supplied their own needs and enabled them to pay an enforced tribute, there was an advance with the inauguration of the way-station period, when the community, through its services to the pack trains, contributed to a branch of world commerce, though the members of the community had little or no interest in the trade itself. At a slightly later period the agricultural and manufacturing industries were producing commodities for consumption in other regions of Mexico and in foreign lands.

[39] *Mexican Yearbook*, 1908, pp. 523–524.
[40] *Ibid.*, pp. 512–513.

In the latest stage of development, agriculture is producing, as in the beginning, primarily to satisfy the requirements of the local population; while the factories, utilizing the power in which is expressed the "Joy of the Waters,"[41] and finding in the rural population a potential supply of labor, are reaching out into world commerce to secure products of the soil of other lands, which products they are transforming into commodities demanded by communities in various parts of the Republic.

Throughout the various stages of its development, Orizaba has been one of the more prosperous of Mexican communities, and the regularity of returns from labor expended has been reflected in the contentment of the people and their distaste for political upheavals. Even in the semi-legendary pre-Spanish history this tendency is noted. The tribesmen who made the first settlements at Orizaba had been, while on the plateau, turbulent trouble makers; but once established in the fruitful valley which they had chosen as their new home, they lost their warlike propensities and devoted themselves to agriculture and the arts of peace.[42] Revolutions have not been wont to originate in Orizaba. On the contrary, the citizens of Orizaba, worn out with many years of constantly-recurring disturbances, welcomed the French intervention, hoping that the Maximilian régime would give them stable government with security of life and property; and they remained loyal to the empire until convinced of its impotence.[43] During the recent revolutionary period, although agrarian changes and labor troubles have interfered with economic conditions, Orizaba has been one of the less disturbed localities of the Republic.

[41] The name *Orizaba* is said to be a contraction of the name of the pre-Spanish village, Ahauializapan, the translations of which include the two ideas of *joy* and *waters* variously combined.

[42] Naredo, *op. cit.*, Vol. I, Book I, p. 17; and Clavigero, *op. cit.*, Vol. I, p. 102.

[43] Naredo, *op. cit.*

THE BEET SUGAR INDUSTRY OF NEBRASKA AS A RESPONSE TO GEOGRAPHIC ENVIRONMENT

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NEBRASKA now ranks among the foremost states of the Union in the beet sugar industry—during the last few years it has held fourth place. Since this industry has had such a marked growth in the state, the study of its response to its geographic environment, both physical and economic, has brought out some interesting facts and relationships, which it is the purpose of this paper to present.

Although sugar production in Nebraska started in 1890, the major part of its development has occurred since 1914 and therefore it is properly considered one of the younger industries of the state. The first factory was established at Grand Island in 1890, the second was erected at Scottsbluff in 1910, the third in 1916 at Gering; and since then plants have been erected at Bayard and Mitchell. The areas producing sugar beets are chiefly in the irrigated sections of the North Platte, the Platte and the Republican River valleys of western Nebraska (Fig. 1).

ENVIRONMENTAL FACTORS IN SUGAR BEET PRODUCTION

As far as temperature only is concerned, experiments have indicated that beets attain their greatest perfection in a zone of varying width, through the middle of which passes the summer isotherm of 70° F. Beets require a long day with plenty of sunshine during the growing season. Abundant moisture is needed in the early growth of the plants to insure roots of good size, and this should be followed by a period of less rainfall, more sunshine, and cool nights, for the development and storage of sugar.

The abundance of sunshine in the irrigated regions of western Nebraska is indicated by the number of clear days, from 137–160, in the growing and harvesting seasons of the last decade (Table I).

TABLE I

TOTAL NUMBER OF CLEAR DAYS DURING THE GROWING AND HARVESTING SEASON AT SCOTTSBLUFF, NEB.[1]

1914.....	160	1920.....	137
1915.....	139	1921.....	159
1916.....	154	1922.....	159
1917.....	149	1923.....	137
1918.....	150	1924.....	153
1919.....	149		

According to the Weather Bureau records of 1916 to 1924, the average daily temperature for the growing months (June, July, and August) varied from 69.7° at Scottsbluff to 77.2° at Grand Island, the eastern limit of sugar beet production (Table II). The temperature during the daytime rarely exceeds 100° F., while the nights quite often drop to 40° F. during the growing season. The deficiency in rainfall can be supplemented by irrigation to suit the needs of the plant.

RESPONSE OF AREA HARVESTED TO CLIMATIC CONDITIONS

Practically the entire acreage planted is harvested. In this respect Nebraska and Utah rank highest among the states in the Union. During the last five years an average of 96.1 per cent of the planted area was harvested in Nebraska. The corresponding averages for the other leading states were Utah, 96.33 per cent; California, 88.14 per cent; Colorado, 87.44 per cent; and Michigan, 83.63 per cent.[2]

[1] Data from reports of the United States Weather Bureau Station at Scottsbluff, Neb.

[2] From the United States Department of Agriculture, Yearbook, 1923.

The percentage of the planted area which is harvested in Nebraska is rather closely related to the number of clear days during the growing season, June, July and August. The percentage of the harvest is generally in direct proportion to the number of clear days during the growing season. The degree to which this principle actually works out is indicated by Fig. 2.

The growing season is the critical period for damage by diseases and insects as well as by hail storms. Since Nebraska's sugar industry is young it does not suffer so much from insect and fungus diseases as does the industry in some other states. Clear, warm days with cool nights and little rainfall are not conducive to plant diseases or insects as are rainy, cloudy days.

The lower production points in the graph are also often influenced by late frosts in May. However, if the frosts do not occur too late the beets are replanted.

TABLE II

AVERAGE TEMPERATURE AT SCOTTSBLUFF FOR JUNE, JULY AND AUGUST, ALSO MAXIMUM AND MINIMUM TEMPERATURES AND DATES AT SCOTTSBLUFF, NEB. [3]

		Temperature	Maximum		Minimum	
Year	*Month*	*Ave.*	*Temp.*	*Date*	*Temp.*	*Date*
1916	June	63.8 F.	100° F.	28	35° F.	7,8
	July	75.6	100	15	49	13
	Aug.	69.8	94	2, 15	41	22
	Ave.	69.7°				
1917	June	65	100	29	34	2
	July	74.6	101	24	47	1, 16
	Aug.	68	100	3	41	24
	Ave.	69.2°				
1918	June	71.3	101	10, 15	38	2, 30
	July	72.4	100	2, 27	44	1
	Aug.	71	101	2	42	31
	Ave.	71.5°				
1919	June	69	104	23	31	3
	July	75.8	104	9	50	21
	Aug.	72.3	100	11	43	22
	Ave.	72.3°				
1920	June	70.3	98	8	34	4
	July	76.6	103	22	45	8
	Aug.	70.5	94	23	40	29
	Ave.	72.4°				
1921	June	69.9	99	29, 30	45	20
	July	75	101	21	46	3
	Aug.	71.8	100	18	45	7
	Ave.	72.2°				
1922	June	70.4	101	22	34	2
	July	71.2	103	14	37	12
	Aug.	75.2	99	12, 27	49	25, 27
	Ave.	72.3°				
1923	June	66.7	98	24	44	7
	July	74.7	97	7	49	29
	Aug.	69.5	95	13	45	27
	Ave.	70.3°				
1924	June	67.3	101	18	37	9
	July	71.8	100	20	45	25
	Aug.	72	104	2	42	22
	Ave.	70.3				

SUGAR CONTENT OF BEETS AS RELATED TO CLIMATE

The percentage of sugar in beets is dependent on three main factors: (1) Climatic conditions, (2) selection of good seed, and (3) care in the production and handling of the beets.

The sugar content (sucrose) of the beets seems to vary especially with the differences in the amount of rainfall and the number of clear days during the harvesting months, September, October, and November (Fig. 3).

[3] Data from reports of the United States Weather Bureau Station at Scottsbluff, Neb.

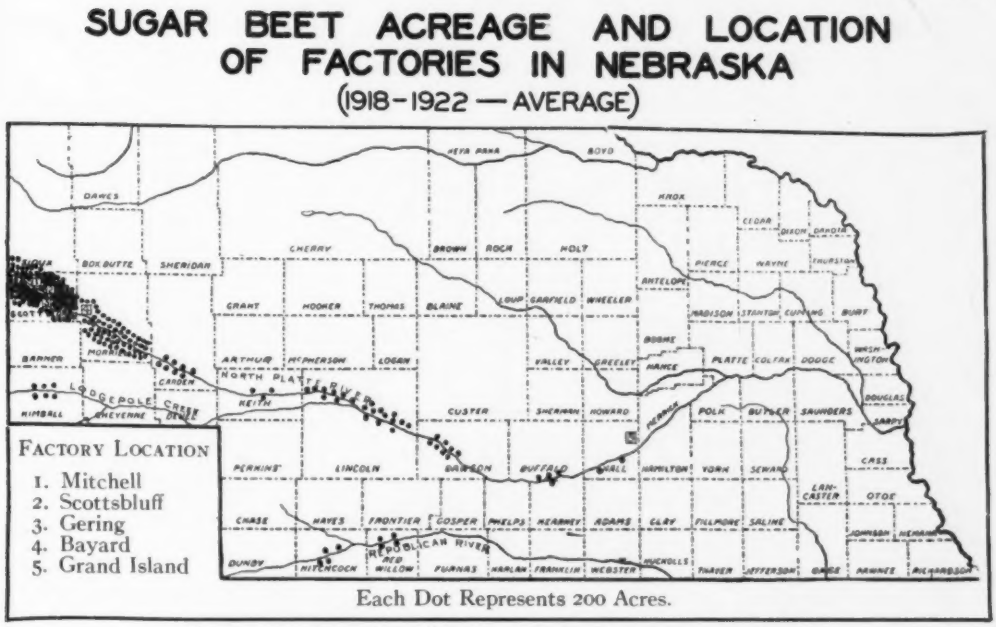

FIGURE 1.—Sugar Beet Acreage, by Counties, 1918–1922 Ave.*

County	*Acres*	*County*	*Acres*
Scotts Bluff	35,706	Red Willow	802
Morrill	10,849	Hitchcock	799
Lincoln	3,986	Keith	642
Sioux	1,974	Buffalo	561
Garden	1,521	Hall	483
Dawson	1,515	Kearney	253
Kimball	1,114		

*Data compiled from Reports of the Nebraska State Board of Agriculture and the United States Bureau of Crop Estimates at Lincoln, Neb.

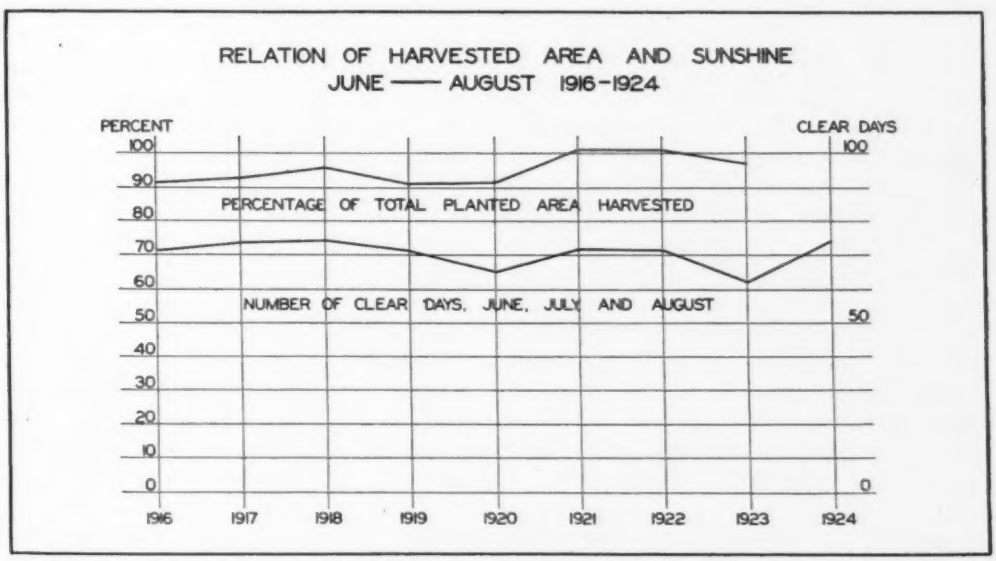

FIGURE 2.—The area harvested each year depends very closely upon the amount of sunshine for the season. Source of Data: Yearbook, United States Department of Agriculture, 1923.

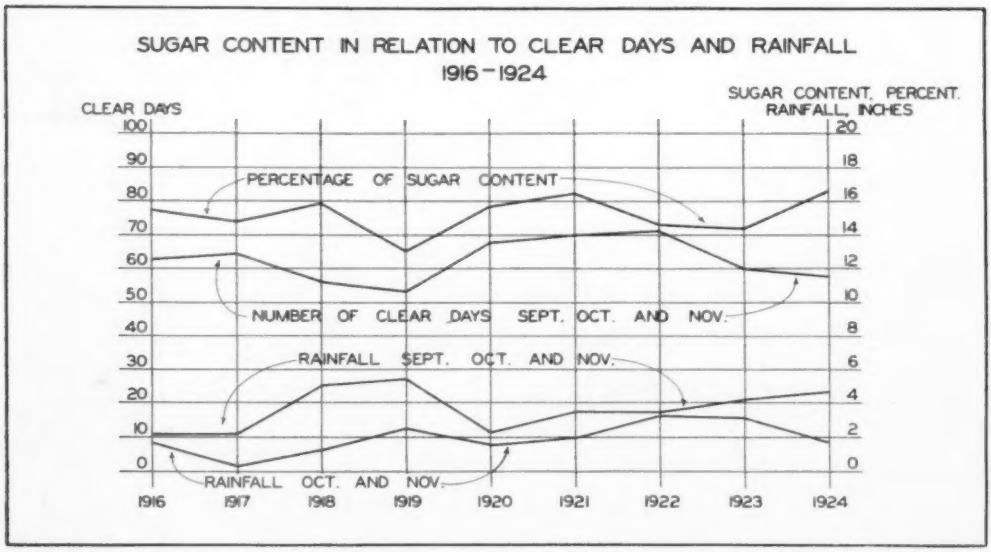

FIGURE 3.—Source of Data: Yearbooks, United States Department of Agriculture, United States Bureau of Crop Estimates at Lincoln, Nebraska, and Reports of the United States Weather Bureau Station at Scottsbluff, Neb.

The sucrose of Nebraska beets is generally from 14½ to 16½ per cent. During the years of 1916 and 1917 the sugar content was approximately 15 per cent, and in 1918 the sugar content increased to 16.05 per cent, which was accompanied by a decrease in the number of clear days and an increase in rainfall, the greater portion of which fell in September, rather than in October and November. The 1919 beet sugar content dropped to 13.04 per cent, the number of clear days decreased, and the precipitation was more than 5 inches, of which 2½ inches fell during October and November. In 1920 the sugar content again increased, the clear days increased, and the rainfall was less. The 1921 crop shows a sugar content of 16.6 per cent, more clear days, and although the rainfall was higher it came early in the season rather than in October and November. In 1922 the sugar content was lower than in 1921, which, although not accompanied by much decrease in the number of clear days, was characterized by much rain in October and November. In 1923 the sugar content declined to a still lower point, the precipitation increased, and thus the number of clear days was decreased. The estimated sugar content for 1924 was 16.4 per cent. Although the seasonal rainfall was greater, most of it occurred early, leaving the October and November precipitation comparatively low (Table III, and Fig. 3).

The data presented show that the sugar content varied quite generally with the amount of rainfall in October and November and also in general with the number of clear days. The highest percentage of sugar occurred when the October and November rainfall was low. The data in Table IV, based on the results of the experiments at the sugar factories, show that the percentage of sugar and the tonnage of beets per acre were both increased when the beets were (Fig. 4) allowed to remain in the ground until late in the fall (Table IV).

If there is much rain during the late growing and harvesting months, there is less sunshine and cooler weather, hence not so much sugar is formed. The temperature at that time is also lower, resulting in slower evaporation and therefore the water remains in the soil longer thus diluting the sucrose. After the beets are harvested, they are often stored in piles for some time before they

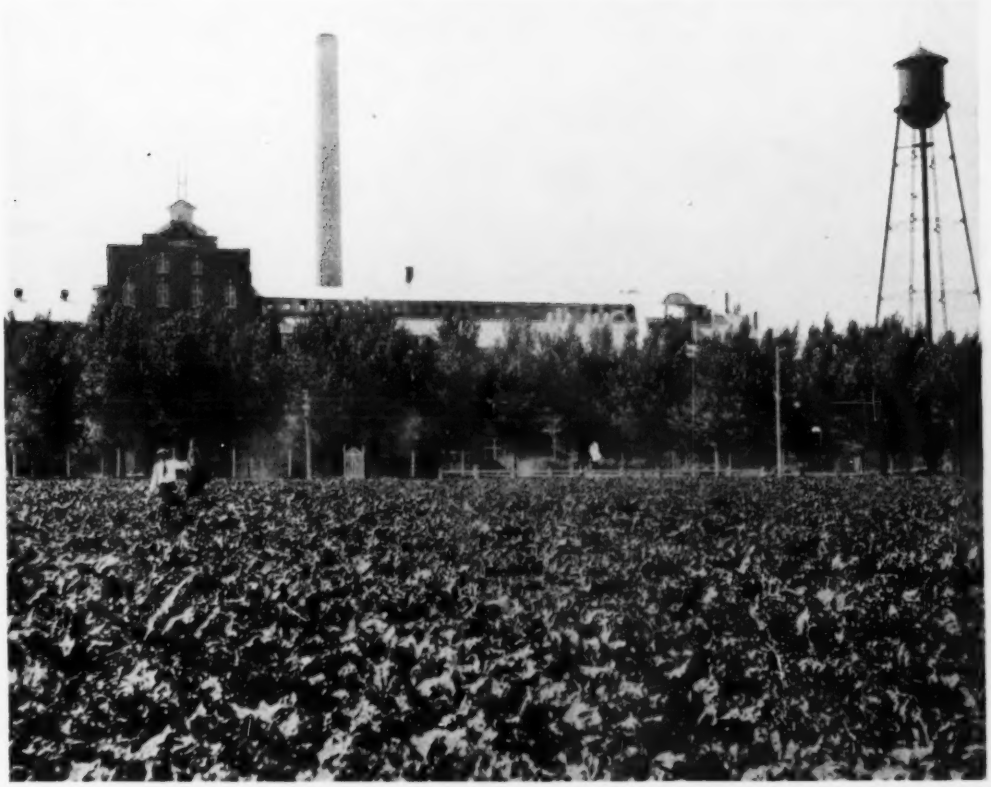

FIGURE 4.—The Scottsbluff Sugar Factory, belonging to the Greatwestern Sugar Company, the second erected in Nebraska, has a daily capacity of 8,850 bags. The field shown, just across the highway from the factory, containing 54.70 acres, yielded an average of 20.30 tons per acre. (Courtesy of Lyman H. Andrews, Greatwestern Sugar Company, Scottsbluff, Neb.)

can be marketed (Figs. 7 and 10). If there is much moisture during that period, the beets are leached to some extent, and the sugar content is lowered.

Freezing and thawing also reduce the amount of sugar. The sugar companies desire the farmers to permit the beets to remain in the ground as long as possible because it is in the last part of the growing period that the sugar increases most when the weather conditions are favorable (Table IV). The grower, however,

TABLE III

NUMBER OF CLEAR DAYS, INCHES OF RAINFALL, SEPTEMBER–NOVEMBER AT SCOTTSBLUFF AND THE AVERAGE SUGAR CONTENT OF BEETS, 1916–1924 [4]

	No. of Clear Days, Sept., Oct. and Nov.	Rainfall, Inches				Sugar Content
Year	*Days*	*Sept.*	*Oct.*	*Nov.*	*Total*	*Per Cent*
1916	63	0.42	1.26	0.49	2.17	15.51
1917	64	1.79	0.32	0.02	2.13	14.91
1918	56	3.82	0.54	0.69	5.05	16.05
1919	54	2.91	1.16	1.32	5.39	13.14
1920	67	0.79	1.18	0.34	2.31	15.74
1921	70	1.49	1.14	0.79	3.42	16.60
1922	72	0.13	2.86	0.31	3.30	14.79
1923	60	0.96	2.55	0.55	4.06	14.48
1924	58	2.79	1.61	0.12	4.42	16.40

[4] Data from reports by United States Weather Bureau Station, Scottsbluff, Neb., and Yearbooks, United States Department of Agriculture, and U. S. Bureau of Crop Estimates at Lincoln, Neb.

FIGURE 5.—Terrace of the North Platte Valley near Scottsbluff, used for beet production. The yield in this particular field was 21 tons per acre. The wagon shown has a capacity of 3 tons of beets. The number on the side of the wagon is the contract number between the grower and the sugar refining company. (Courtesy of Lyman H. Andrews of the Greatwestern Sugar Company, Scottsbluff, Neb.)

is quite anxious to harvest his crop early because of the danger of frost.

Because the percentage of sugar and the tonnage produced per acre varies considerably with the quality of seed, the sugar companies give much attention to the selection of good beet seed. The sugar content also varies with the manner in which beets are grown and handled. If they are deformed by growth and bruised in handling the sugar is less.

TOPOGRAPHY AND SOILS

The larger part of the sugar beet acreage is found upon the first and second terraces of the North Platte, Platte, and Republican River valleys because they are quite level and have enough differences in elevation to insure good surface drainage (Fig. 5). The very fine sandy loams and the silt loams are the best soils of the terraces for sugar beet growth. These vary from 14 to 24 inches in depth and are quite generally underlain by 20 inches to 3 feet or more of yellowish-brown silt. Beneath these, many feet of sand are found. The surface soils are rather high in organic matter and both the soil and subsoil contain sufficient fine material to make them retentive of moisture. The looseness and the depth of the soils make it possible to produce roots of uniform shape and good size. Deformed beets usually have a lower sugar content. The porosity of the soils also assists in the drainage. The lower-lying lands are not so well drained and it is claimed that some of the beets produced on these soils contain 1 per cent less of sugar than those grown on the higher, better drained terraces. Inasmuch as the soils of the valleys mentioned above are well drained and usually contain the necessary ingredients, they are desirable lands for the growth of beets; hence this factor has contributed in a marked degree to the establishment of this important industry in the state.

FIGURE 6.—Showing the method of topping beets. The tops are cut off just below the crown. (Courtesy of Lyman H. Andrews, Greatwestern Sugar Company, Scottsbluff, Neb.)

ECONOMIC RELATIONS

Economic geography holds an important position in the production of sugar beets in Nebraska. The economic relations are quite definitely illustrated by the data showing the acreage and the production of beets, the price per ton, the price per bushel of wheat in Nebraska and the acreage of wheat and alfalfa in Scotts Bluff and Morrill Counties, selected as type areas in the beet producing region (Table V).

First it may be stated that the development of irrigation has made more than 400,000 acres of land available for cultivation, most of which is located in western Nebraska. In 1914, Scotts Bluff and Morrill counties had only 85,900 acres under cultivation, compared with approximately 350,000 acres in 1923.

The three major crops are wheat, sugar beets, and alfalfa, which generally are grown in rotation. Wheat and sugar beets are the two principal money crops while alfalfa is raised for the hay used in conjunction with beet pulp as feed for fattening sheep and cattle and also for the fertility which it contributes to the soil.

Table V shows that since 1914 the acreage of sugar beets in Nebraska increased rapidly, 1918 excepted, until 1920 when it reached the maximum production of 79,000 acres. In 1921 and 1922 the producing area decreased, while in 1923 and 1924 the acreage increased to 65,590 acres. The prospects for 1925 are very good for a larger production.

The beet production generally fluctuates with the changes in price per ton. The sugar beet acreage declined in 1918 although the price for beets reached its maximum, $11.96 per ton. This decline was no doubt due to (1) the entrance of many young men into the army, creating vacancies which the men and women field workers could fill with more remuneration and less labor than thinning, hoeing, and caring for beets, and (2) the increased

TABLE IV

RATE OF INCREASE OF SUGAR, PURITY AND WEIGHT OF SUGAR BEETS GROWN IN THE NEBRASKA DISTRICT FOR THE GREATWESTERN SUGAR COMPANY, 1923 AND 1924 [5]

	1923			1924
Ave. Date of Sampling	*Average Purity*	*Per Cent Sugar*	*Ave. Wt. in Ounces*	*Per Cent Sugar*
Sept. 5	77.1	10.47	26.0	11.44
12	77.6	11.56	27.9	12.17
19	79.6	12.25	30.9	12.68
26	80.2	13.35	31.0	13.61
Oct. 3	79.8	13.69	32.4	14.40
10	81.7	14.23	32.3	15.24
17	83.0	14.67	33.5	15.98
24	83.3	14.70	33.7	16.26
31	82.0	15.21	34.9	16.96
Nov. 7	82.6	15.19	32.9	18.15

acreage of wheat in Scotts Bluff and Morrill counties. The price of wheat in 1917, 1918 and 1919 was guaranteed at approximately $2.00 per bushel. At that price the farmers could realize more money with less expenditure of labor in raising wheat than sugar beets. In 1920 a plan whereby the rate for beets was to be determined by the price which the factories would receive for the finished sugar. Ordinarily the change in production of a farm product follows a year later than price change, but that is not so true in the sugar industry because the

TABLE V

DATA SHOWING COMPARATIVE ACREAGES AND PRICES OF PRINCIPAL CROPS, 1916–1924 [6]

	Sugar Beet Production in Nebraska			*Wheat Acreage, Scotts Bluff and Morrill Counties*	*Price per Bushel of Wheat*	*Alfalfa Acreage, Scotts Bluff and Morrill Counties*
Year	*Acreage*	*Tonnage*	*Price per Ton*			
1916	44,800	404,000	$6.17	26,314	$1.60	41,944
1917	55,520	444,000	7.22	23,369	1.95	65,075
1918	36,100	450,000	9.96	51,037	1.97	53,056
1919	65,000	601,000	10.90	54,697	2.02	50,597
1920	79,000	718,000	11.96	51,998	1.31	47,432
1921	72,000	773,000	6.59	60,370	.83	43,776
1922	55,000	703,000	7.79	72,901	.96	41,636
1923	60,000	640,000	7.45	43,319	.83	34,782
1924	65,590	766,000	6.50 [7]	41,253	1.22	38,228

the beet price and the acreage increased while the wheat acreage dropped slightly, indicating that the high price paid for beets made more profit for the grower than did wheat. In the latter part of 1920 and during 1921 came the unsettled financial conditions due to the after effects of the war. Sugar prices dropped and as a result the price of beets decreased to $6.59 a ton, nearly a 50 per cent reduction from peak prices. Prior to 1921 the sugar companies had paid the farmers on the basis of sugar content, but in 1921 this method was changed to acreage of beets to be produced are secured in the winter by contracts between the sugar companies and growers, hence the farmers know about what price they will receive. This is illustrated by both the decrease in acreage and the lower price coming in the same year, 1921.

Even though there was a decrease in the price of wheat in 1921 and 1922, the proportion was not so great as in the beet

[5] Report from the Greatwestern Sugar Company, Scottsbluff, Neb.

[6] Compiled from year books, United States Department of Agriculture, reports of United States Bureau of Crop Estimates at Lincoln, Yearbooks, Nebraska State Board of Agriculture and reports from Sugar Companies.

[7] Price not yet finally made.

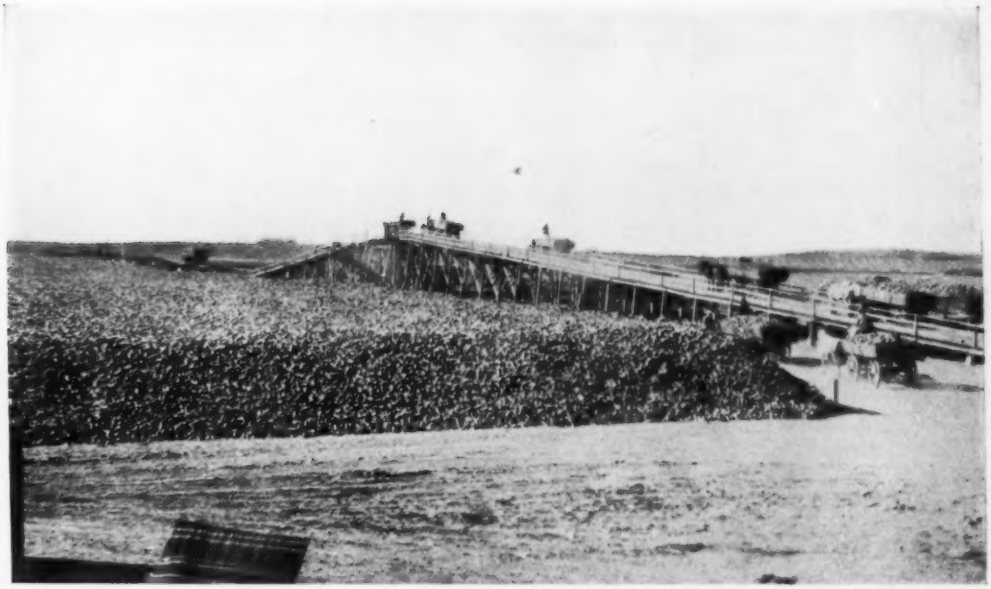

FIGURE 7.—A receiving station, showing a portion of an 18,000-ton storage pile, which after the harvest period, will be reloaded and shipped to the factory, 15 miles distant. (Courtesy of Lyman H. Andrews, Greatwestern Sugar Company, Scottsbluff, Neb.)

industry, and as a result the farmers planted more wheat. Since 1921 the price of beets has improved and with that came an increased acreage. In 1924 the preliminary reports showed a production of 766,000 tons of sugar beets, a crop which was second only to that of 1921 in tonnage although the acreage was less. The surplus of wheat and the low prices of 1921 and 1922 caused the wheat acreage to again decrease.

The alfalfa acreage has had a steady decline from an area of 65,075 in 1917 to 34,782 acres in 1923, indicating that the farmers have been realizing more profit from beets, wheat and other crops and that alfalfa for feed could be purchased from other sources.

CONTRACTS AND LABOR

The sugar beets of Nebraska are produced more scientifically than is wheat, corn, or other crops. The sugar factories have field superintendents whose duties are to select field men. During the winter these field men make contracts with the growers for the production of a certain area of beets to be delivered at the factory at a stipulated price per ton. They also assist the farmers in securing good seed. The labor is generally contracted and the field man aids the grower in obtaining the so-called "beet workers."

The sugar beet industry gives employment to many people during the winter and summer. It is estimated that the labor needed to produce an acre of beets is more than 10 times that required for the production of an acre of wheat. In 1924 approximately 2,000 growers raised beets for the factories of Nebraska. In the production of 60,000 acres of beets in western Nebraska, it was necessary to employ about 6,000 laborers to care for the hand work (Figs. 6, 8, and 9). Of this number one-third were Mexicans and the other two-thirds were German-Russians. Every spring there is an exodus of beet workers from the larger cities, such as Omaha, Lincoln, and Hastings, to the beet growing districts. They return in the fall when the crop has been harvested. There are very few Japanese workers. The Mexican laborers are becoming more numerous, replacing the

FIGURE 8.—A beet working family at Scottsbluff. The beets are all topped by hand, the tops placed in windrows for cattle and sheep feed and the beets placed in piles. (Courtesy of Lyman H. Andrews, Greatwestern Sugar Company, Scottsbluff, Neb.)

German-Russians who are decreasing in numbers due to their renting or buying farms or entering other lines of work.

This has a tendency to decrease the number of minors employed in the beet fields because, generally speaking, the Mexicans do not have as many children in their families as do the Russians.

After the crop is produced, much labor is also required during the campaign (the sugar manufacturing season) which usually lasts from the latter part of September to February or March. Besides the men employed in the factories many are needed in caring for the cattle and sheep fattened for market.

The children who work in the beet fields are generally well treated, fed, and clothed. They live out of doors and the exercise generally does not injure them (Fig. 8). There is much difference in the child labor of the beet districts as compared with the child labor of the larger factories where they are often confined in poorly ventilated and lighted quarters and have but one or two things to do continuously. The children generally have a rest period from 10.30 A.M. until

FIGURE 9.—The short-handled hoe method of thinning beets, characteristic of the Mexican and Japanese workers. (Courtesy of Lyman H. Andrews, Greatwestern Sugar Company, Scottsbluff, Neb.)

about 1.30 P.M., the warmest part of the day.

SOCIAL AND ECONOMIC RESULTS

Among the social and economic achievements which have resulted from the sugar industry are the development of railroads, farms, good roads, cities, and schools. In Scotts Bluff county the number of farms increased from 421 in 1900 to 1,391 in 1920, due primarily to the extension of irrigation and the introduction of intensive farming. As a result the number of people per square mile in Scotts Bluff county has changed from 2.6 in 1880 to 28.8 in 1920. The percentage of increase in the population in 1920 over that of 1910 was more than 147 per cent, one of the highest percentage gains in county population in the United States.

In 1924 about 105,000 tons of sugar were manufactured, requiring 766,000 tons of sugar beets, 112,000 tons of coal, 42,700 tons of coke, 44,250 tons of limerock and 100 tons of sulphur (Figs. 7, 10 and 11). In addition the Gering, Bayard, and Mitchell factories produced 23,500 tons of dried pulp of which 13,000 tons were shipped to Georgia, Alabama, and Florida (Fig. 11).

Much freight is also furnished by the transportation of thousands of cattle and sheep which are fattened for market on dry and wet pulp, beet tops and alfalfa (Fig. 12). In 1924, 200,000 sheep and lambs, and 22,000 head of cattle were fed in the beet regions. The haulage of the railroads is also augmented by the passenger traffic to and from the region.

This indicates that the sugar industry has led to much freight and passenger traffic and consequently to the extension

FIGURE 10.—The special beet piles at the Mitchell Sugar Factory containing 5,000 tons, which were flumed in after all of the direct delivery beets were sliced. This net system of piling is only in use at this factory and is not representative of the regular method used in piling, which is to shovel the beets from the wagons to the piles by hand. (Courtesy of Lyman H. Andrews, Greatwestern Sugar Company, Scottsbluff, Neb.)

of the railways. The region is served by both the Burlington and the Union Pacific railways. The last-named route has recently been extended into Wyoming.

The schools of the beet growing districts are well developed and the children have opportunity of attending full time. There are now in the Scottsbluff district some six weeks' summer schools for the children of the beet workers. These sessions are held from the middle of July until the last of August, the slack period of hand work in the beet fields. Since the teachers who teach the summer schools resume the work in the schoolroom in the autumn after the beets have been harvested, the children do not lose any school time.

The question has often been raised as to the physical condition of children who work in the beet fields as compared with the non-beet workers. The following table of vital statistics which are a part of the report of the school nurse at Scottsbluff gives a direct answer to this question (Table VI).

"We have three elementary schools in which approximately 10 per cent of the children are beet workers. We have two schools in which 70 per cent of the children are beet workers and we have three schools in which 90 per cent of the children are beet workers. We will group these schools according to the per cent of beet workers and designate them as A, B, and C.[8]

"The following figures show that considering all types of defects there is very little difference between beet workers and non-workers; what advantage there is,

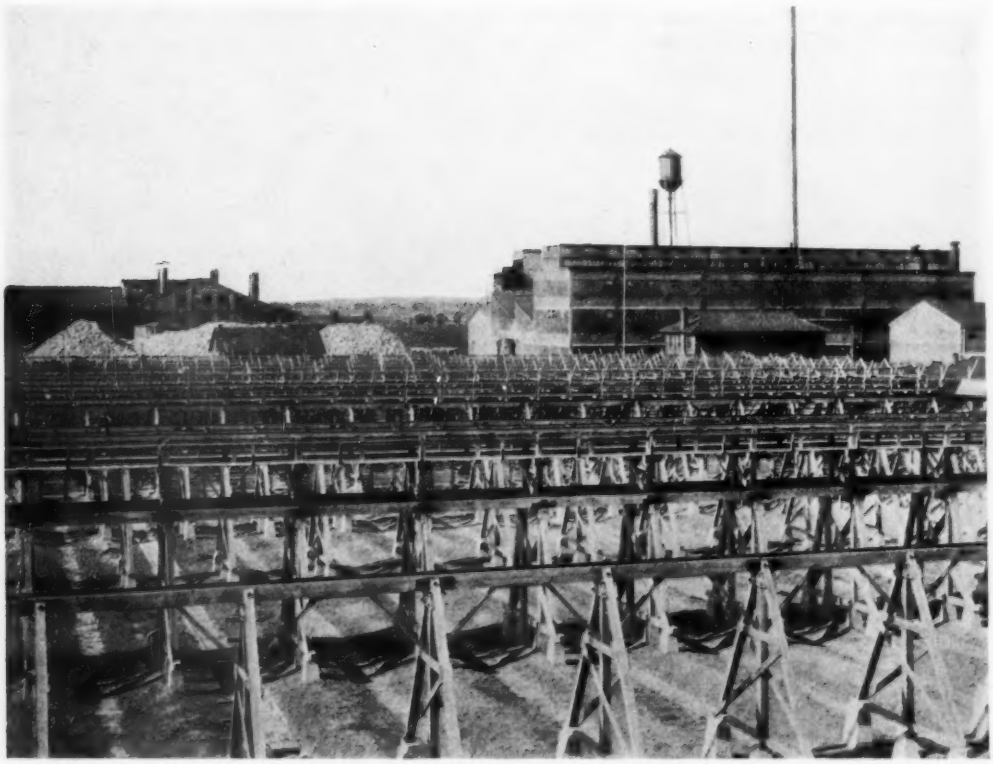

FIGURE 11.—The beet storage grounds showing the flumes which carry the beets into the Gering Factory, shown in the right background. The pulp drying plant is shown in the right background. The pulp drying plant is shown in the left background. Piles of limestone are shown in front of the drying plant. During the campaign of 1924, 486,000 bags of sugar were manufactured at the plant. (Courtesy of Lyman H. Andrews, Greatwestern Sugar Company, Scottsbluff, Neb.)

FIGURE 12.—During the winter 1924–25 in the North Platte Valley, 132,000 head of sheep and 14,600 head of cattle were fed on the by-products of the sugar beet industry, which are beet pulp, beet tops, and refuse molasses. (Courtesy of Lyman H. Andrews, Great western Sugar Company, Scottsbluff, Neb.)

being in favor of the beet workers as shown by the smaller per cent of defectives in the school with 70 per cent of beet workers. The percentages of defective eyes, ears, nose, and throat are decidedly in favor of the beet workers; defective teeth slightly to the disadvantage of the beet workers; all figures pertaining to weight decidedly in favor of the beet workers."

It should be added, however, that many of the children who leave the larger cities in the spring and return in the fall lose some of the time in school, and this causes inconveniences in the city school work, as well as a loss of training for the children.

CONCLUSION

The beet sugar industry has responded favorably to the climatic conditions, rainfall excepted, of Nebraska. The lack of moisture has been supplemented by irrigation. The well-drained, fertile soils of the terraces of the larger rivers produce beets of good size and shape with a high sugar content. The intensive cultivation required for beet production together with crop rotation insures the continua-

TABLE VI

VITAL STATISTICS OF SCHOOL CHILDREN AT SCOTTSBLUFF, NEB.[8]

	A	*B*	*C*
Enrollment	569	698	290
Normal children	45%	57%	45%
Defectives showing any of the defects named below	55%	43%	55%
Eyes	13%	6%	4.4%
Ears	3.3%	1%	1.4%
Nose and throat	19%	11%	13%
Teeth	34%	33%	42%
Standard weight	50%	63%	76%
Below standard, yet normal	33%	24%	14%
Below standard, more than 10% below normal	2.3%	4%	1.5%
Above standard	10%	8%	8.6%
Above normal, more than 10% above standard	3%	2.5%	.6%

[8] From the report of Supt. E. L. Rouse of Scottsbluff Public Schools.

tion of the soil fertility and the successful production of crops.

Thus we find that the sugar industry has been an important factor in the development of the beet growing district in western Nebraska into a prosperous industrial area with successful farms, modern homes, good schools, and cities linked together with splendid lines of communication.

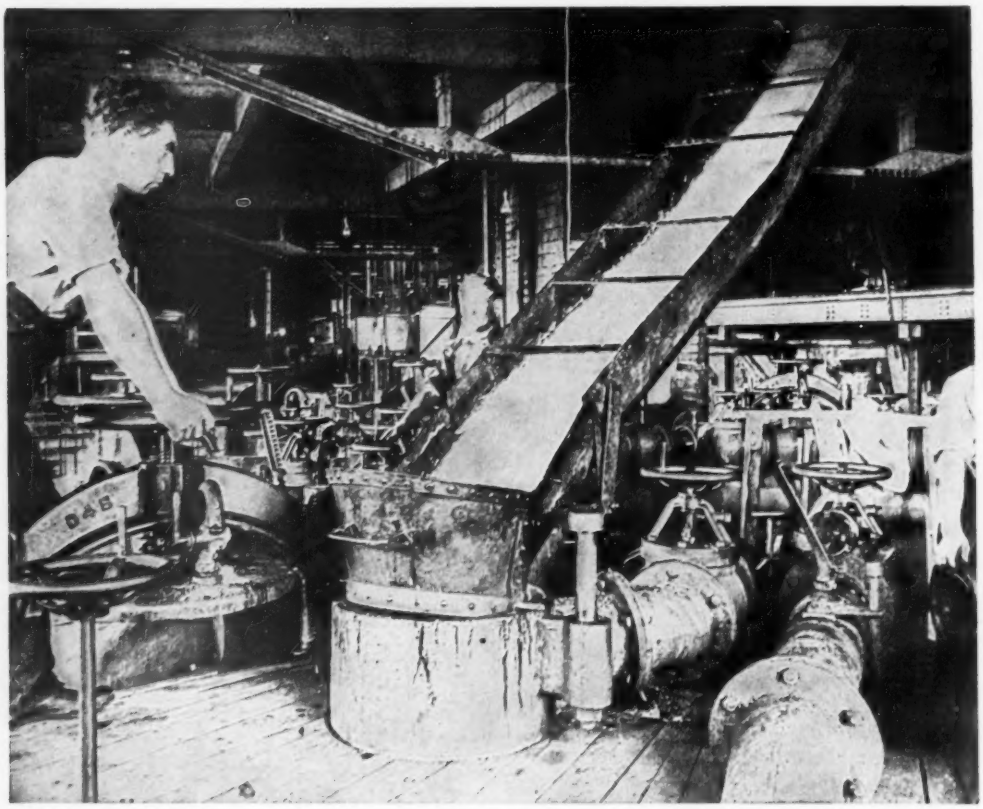

FIGURE 13.—The refinery is the final step in the manufacture of sugar. As the juice pressed from the beets is run from the mills into the vats, and afterward put through the refining processes, the farmer ceases to be immediately concerned and the "ultimate consumer" begins to wonder whether he will have to pay five cents, or seven cents, or nine, at his corner grocery. (Courtesy of the Keystone View Co.)

THE UTILIZATION OF OUR PHOSPHATE RESOURCES

Walter H. Voskuil, Ph.D.
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IT has been said that "the world knows nothing of its greatest men," and surely a like observation would be true relative to its raw materials. To the man in the street "phosphate rock" means nothing; he knows not; he has in all probability never heard the term used. Yet the farmer and the fertilizer man know that it is one of the most important of the world's raw materials, and one in which the world should have a vital interest, seeing that future food production must depend to a great extent upon adequate supplies of phosphate rock. The prospect of the exhaustion of the virgin lands, which are now the main source of the supply of wheat, is coming nearer with each year that passes, and consequently fertilizers will probably play an even more important part in the future than they do at the present time.

Phosphoric acid, the element of which phosphate rock is the purveyor, it is thought, will be generally held to be the most important of fertilizers. It is probably not an overestimate to say that from 50 to 60 per cent of the total quantity of fertilizers used throughout the world consist of one or other of the substances which provide phosphoric acid, and among these phosphate rock is by far the most important.

PHOSPHATE RESERVES

The phosphate deposits of the world may be classified into three large groups, viz., the North American reserves, the North African beds, and the deposits of high-grade phosphate rock on the islands of the Pacific Ocean. There are scattered deposits of minor importance in Russia, Siberia, France, and Egypt, and also a source of phosphoric acid in the slag of the basic bessemer steel furnaces in the iron producing countries of England and Germany.

The geographical distribution of these deposits is fortunate in that they are in close proximity to nearly all the nations practising intensive agriculture. Germany is probably an exception to this, but her enormous deposits of potash place in her hands an exchange material which will serve to counterbalance her deficiency in phosphorus. The extensive deposits of Africa can well take care of the needs of western Europe and India. The islands of the Pacific have ample quantities to supply the needs of Japan and China, and the United States, with the largest deposits in the world, can supply its own requirements.

The principal American reserves are somewhat remotely situated with regard to the areas of intensive agriculture, so that, with the decline of the Florida and Tennessee deposits, a long railroad haul will be necessary to supply the fertilizer demand of the future.

The distribution of the American deposits is shown in the table below:

TABLE I. AMERICAN PHOSPHATE RESERVES

	Long Tons
Florida	227,000,000
Tennessee	88,000,000
South Carolina	1,000,000
Kentucky	20,000,000
Western deposits (Montana, Idaho, Utah, Wyoming)	5,367,000,000
Total	5,703,000,000

THE PRODUCTION OF PHOSPHATE ROCK AND ITS PROBLEMS

The food supply of a nation can be increased either by extending the area under cultivation or by increasing the yields per acre (Fig. 1). In a country such as the United States both methods will no doubt be used, for the maximum production of crops has not yet been reached, and it is difficult to make any predictions

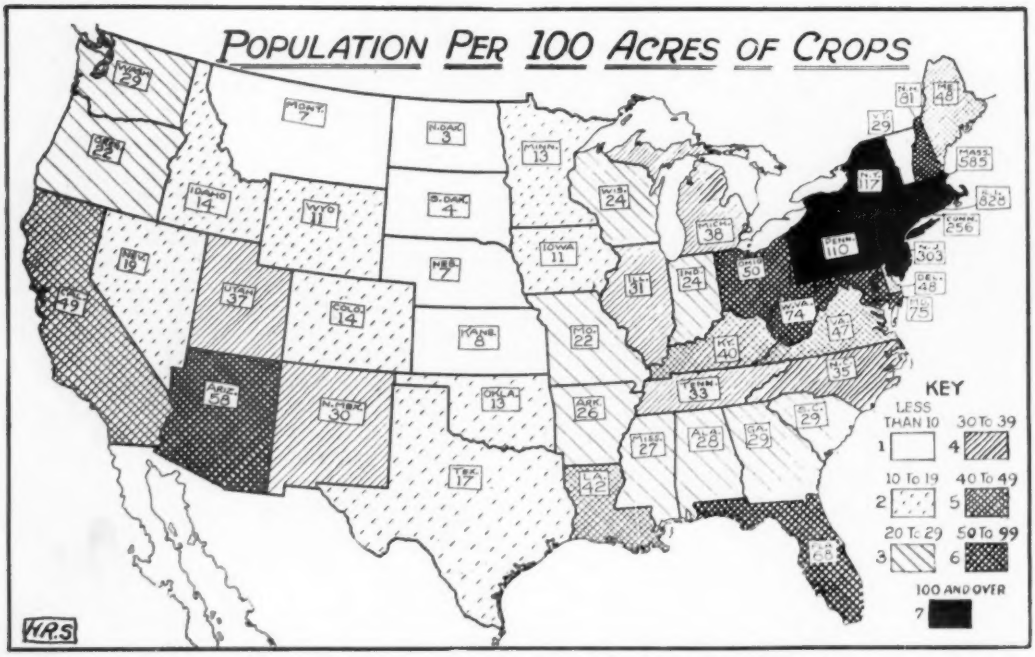

FIGURE 1.—Far more interesting than mere areal distribution is this relationship between population and crop acreage. Dependent upon its food from crop lands far away, how long could the congested industrial district of which New York is the center survive if transportation facilities were suddenly set at naught? Every acre of crop land in the region must be developed to its utmost productivity, by fertilizer and every other possible means, if the supply of food is to be increased, and the cost cut down. (Courtesy of H. R. Smalley.)

as to when this condition will be reached. It is a matter of common knowledge, however, that the better grades of land are now under cultivation and that any further extension of the area will be on lands which, under present prices of farm products, do not give profitable yields. Moreover, before the total possible area is under cultivation, farm practices will be adopted in the older and more productive sections which will tend to increase the yields per acre. This will be accomplished, both by intensive cultivation, that is, by the application of more labor per unit area, and by the application of fertilizers. Because of the relatively high cost of labor it is quite likely that in this country the trend will be in the direction of the increased use of fertilizers. And of the commercial fertilizers, phosphorus is the most important. It is the backbone of the fertilizer industry in the United States today and is the key to increased crop production.

At the present time it is used extensively in the cotton belt of the southeastern states and the Middle Atlantic and New England states for the production of truck crops. Its use elsewhere is practically negligible. The areas of general farming, *i.e.*, the dairy and grain states, have as yet found no need for commercial fertilizers (Fig. 2). It cannot be doubted, however, if the experience of western Europe can be taken as a guide that even these states will eventually employ fertilizers for the production of crops.

For the further growth of the fertilizer industry, certain problems arise, which, if the industry is to develop on a sound basis, are worthy of study and consideration. It may be well to examine the conditions that surround the industry. These conditions are:

1. The material is bulky and much of the cost of fertilizer is represented by transportation costs.

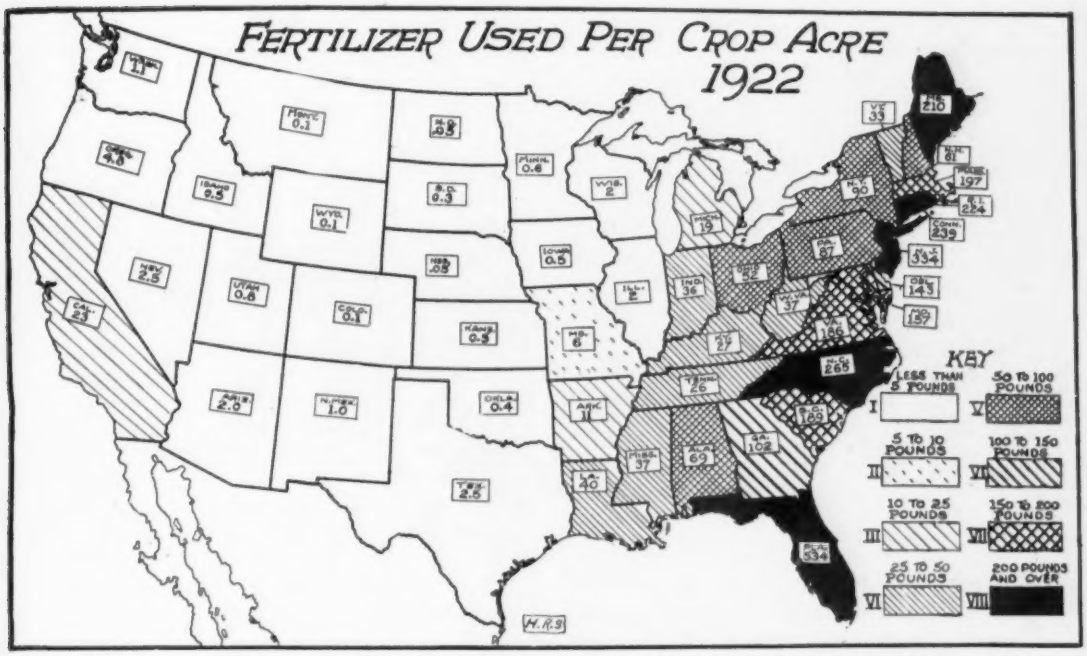

FIGURE 2.—As the pressure of population bears down more heavily upon the land, and more labor is expended upon it, the amount of fertilizer that can be profitably applied to each acre is greatly increased up to a definite limit. (Courtesy of H. R. Smalley.)

2. Sulphuric acid is required for its manufacture, a material which also is bulky, and, moreover, is rarely shipped over a distance of 200 miles.

3. The source of sulphur is Louisiana and Texas, or iron pyrites from Spain.

4. The distribution of the material is sharply limited to a few centers in the southeastern states, and in the western states far from the productive lands, and from water transportation.

5. The manufacture of a concentrated phosphate fertilizer by a new method now being developed, if successful, will require coal or electrical power. Hence the cost of fertilizers will be related directly to the cost of fuel and power.

With these conditions in mind it appears that the problems of producing cheap fertilizer center around the cost of preparation as governed by sulphuric acid, or power, and the cost of transportation. The latter becomes especially significant if attempts are made to introduce on a large scale the use of fertilizers in the Middle West. The bulky nature of the material, coupled with the fact that much of the material must go into the product as a carrier (so-called filler[1]) of phosphorus, makes a study of bulk reduction in relation to freight rates significant.

THE PRODUCTION OF PHOSPHATE FERTILIZERS

Although there are more than 500 patents relating to phosphate fertilizers, the bulk of the material is put upon the market in three forms, viz., raw rock phosphate, acidulated phosphate, and the so-called "complete fertilizers." The quantity marketed from year to year

[1] "Filler" as here used is intended to mean the material other than phosphoric acid that is present in the fertilizer. This does not mean that it consists of material all of which can be eliminated. Phosphoric acid cannot be shipped and applied as a fertilizer as such. It must be combined with some other elements to form a salt. Since all combinations are with phosphoric acid, this is taken as a constant in all forms of fertilizers and a basis for the relative percentages of the different forms of carriers is computed.

varies considerably, but taking an eight-year average, amounts are as follows:

TABLE II

	Tonnage	*Per Cent*
Rock phosphate	63,000	3
Acid phosphate	800,000	18
Complete fertilizers	3,200,000	79

It is to be noted that the quantity of raw phosphate rock is not large. The use of this material for crop production does not appear to be as effective for immediate results as the application of acid phosphate.

PRODUCTION OF RAW ROCK PHOSPHATE

In addition to the mining of the rock the only treatment given to phosphate rock fertilizer is grinding. The cost of mining phosphate rock depends upon a number of factors, most important of which is the depth of the overburden and the cost of removing it. In South Carolina no attempt is made to go much below a depth of twenty feet. In Florida, where a higher grade of rock is found, it is profitable to mine rock having an overburden of greater depth (Fig. 3). According to data obtained from various companies,[2] the cost of mining Florida pebble rock, including washing, drying, etc., ranges from about $1.55 to $2.50 per gross ton, not including amortization of investment or royalties in case the mining is done on that basis, and the cost of mining Tennessee brown rock ranges from about $2.75 to $3.14 per gross ton. Raw phosphate rock of high grade carries about 32 per cent phosphoric acid.

PRODUCTION OF ACID PHOSPHATE

In the manufacture of acid phosphate as now conducted the broken phosphate rock coming from the mines is pulverized by steel rollers in a grinder or mill until from 70 to 90 per cent of it will pass through a fine screen. After the grinding process the pulverized phosphate is conveyed into an acidulator or revolving pan equipped with paddles or stirrers, where it is mixed with an equal portion of sulphuric acid. The principal items of

[2] *Report of Fertilizer Industry*, Federal Trade Commission, August 19, 1916.

FIGURE 3.—A Florida phosphate deposit in which steam-shovel, and other modern equipment, reduce the cost of production to the minimum. (Courtesy of the U. S. Geological Survey.)

cost in the manufacture of acid phosphate are rock, including the freight on it from the mines to the plant, and the sulphuric acid. Data secured by the Federal Trade Commission for the year 1913 for 19 large plants operated by the seven largest fertilizer producers show that the costs of manufacture vary from six to seven dollars per ton. High grade acid phosphate contains about 16 per cent phosphoric acid. Eighty per cent of the acid phosphate is sold in mixed fertilizers.

THE PYROLYTIC METHOD OF FERTILIZER MANUFACTURE

The present method of phosphate fertilizer production, as has been noted above, is either grinding up the rock to form a fine powder, or grinding and adding an equal amount of sulphuric acid to make acid phosphate. The factors that have favored the production of this form of fertilizer are, first of all, the existence of deposits of high grade. For "floats" (ground rock phosphate), the material must contain at least from 60 to 70 per cent of tri-calcium phosphate. For the

manufacture of acid phosphate, a high grade material also is required, although, if not present in the mines, it is purified by the removal of sand, clay, and soft phosphate. This results in a loss of phosphate rock conservatively estimated at 50 per cent.

During recent years considerable attention has been devoted to producing phosphoric acid by the pyrolytic process and, while the general scheme is not new, its adaptation to the production of phosphoric acid for fertilizer purposes has not been sufficiently developed to convince the industry that it is economically superior to the old method now so generally employed. Briefly, the process consists of submitting intimate mixtures of phosphate rock, sand, and coke to the high temperatures attained either in an electric or fuel fired furnace, thereby driving the phosphoric acid out of the phosphate rock and replacing it by silica, the final product being relatively pure phosphoric acid and silicate of lime. The former is volatilized and collected in a suitable manner, and the latter tapped out of the furnace from time to time as a molten slag.

The concentrated product obtained by this process may be either strong phosphoric acid in liquid or crystalline form which can be shipped in lead lined cars and wooden containers, or double superphosphate (containing from 40 to 50 per cent phosphoric acid) which is made by treating phosphate rock with the phosphoric acid just mentioned. Even if the cost of a unit of phosphoric acid made by the sulphuric acid method is cheaper than that made by the furnace process, the latter might well be economically superior because of the great conservation of raw materials and the enormous saving of freight on products.

The desirableness of the pyrolytic forms of phosphate fertilizers has not, as yet, been the subject of extensive field experiments, although there is every reason to believe that these forms will adapt themselves favorably to application to the soil. The advantages may be summarized briefly as follows:

1. Low grade and run-of-mine phosphates can be used.
2. The use of sulphuric acid is eliminated.

FIGURE 4.—Hydraulic methods of quarrying and sorting phosphate rock in the deposits of Florida, from which great quantities have been exported to the European regions of intensive, highly-developed agriculture. (Courtesy of the U. S. Geological Survey.)

3. Reduction in bulk will serve to reduce freight charges.

SURVEY OF THE INDUSTRY TODAY

A survey of the phosphate industry today shows that it is a local industry. Mining of the material is confined to the areas near water transportation or in the center of areas of consumption (Fig. 4). Transportation of the prepared material is over shorter distances than the raw rock out of which the finished product is made due to the higher transportation costs of the latter. The costs and difficulties attending the transportation of the fertilizer materials as manufactured at the present time have served to confine the industry to the eastern and southeastern states.

THE RATIONAL TREND OF DEVELOPMENT

The fertilizer industry is still in its infancy and, because it is likely to become of great importance in American agriculture, it may be well to examine the probable trend of its development and to discover such problems as may arise.

At the present time approximately 85 per cent of the rock is mined in Florida in close proximity to water transportation, and used in the states bordering the Atlantic Ocean. Yet these southeastern states contain but a small proportion of the total phosphate reserves of the United States. At least 94 per cent of the known reserves are in the western states (Fig. 5). That production will decline and eventually cease in the eastern states is evident. South Carolina production has decreased from 450,000 tons in 1894 to 44,000 tons in 1920, and in 1921 ceased altogether. Tennessee has been producing more than 400,000 tons since 1916, but its reserve is relatively small and its decline is but a question of time. Florida has still large reserves, although its richest and most available deposits have been extensively removed. With the decline of the eastern fields will come the cessation of exports.

THE WESTERN STATES

The problems that face a fertilizer industry in the western states are mainly those of transportation costs. The deposits are (1) a long distance from the agricultural areas, (2) a long distance from the source of raw materials for the manufacture of sulphuric acid. In order to determine more fully how great the problem is it may be well to examine the needs and probably wants of the consumer.

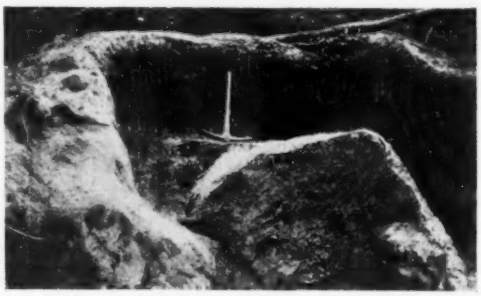

FIGURE 5.—An outcrop of high-grade phosphate rock in one of the deposits of the Idaho-Montana district, a region of vast reserves that will not be exploited until the economic pressure upon the land enables it to bear the high cost of transportation from the mountains to the crop-producing sections of the country. (Courtesy of the U. S. Geological Survey.)

The nearest market for the goods is the agricultural region of the Mississippi Valley. Hitherto the consumption of fertilizers in this region has been negligible. The question is, Will a demand for phosphate fertilizers arise, and, if so, to what extent? In attempting to answer this question, it must be borne in mind that the farmer can produce crops without fertilizer, if necessary; and he will not purchase fertilizers unless he sees clearly that it is to his profit to do so. He cannot be induced to buy by the argument that the phosphorus content of his soil must be maintained at its original level. He certainly will not use his capital in an outlay for fertilizers to increase his yields when present production is putting a surplus of grains on the market. Clearly, then, to introduce a fertilizer into this region where the

material is not being used necessitates that the cost be cut to the lowest possible figure. These costs are:

1. Mining.
2. (a) Acidulating, if acid phosphate is manufactured.
   (b) Coke and sand, if the pyrolytic method of production is used.
3. Transportation.

The farmer's preference for either acid phosphate or pyrolytic phosphate will be governed by the net higher gain he receives by the use of either over the cost.

The total cost of the material per unit of phosphoric acid, made up of the three elements cited above, in the various forms of fertilizer is, of course, unknown. Mining costs will differ for each process. It is possible, as shown by the researches of the Bureau of Soils, to use rock of a lower grade for the pyrolytic process than for the acid phosphate process. Hence the cost of high grade rock will have to be balanced against the cost of lower grade rock. Next, the cost of sulphuric acid will have to be balanced against the cost of coke and sand. Finally, the cost of transportation will have to be calculated. Here the acid phosphate is at a disadvantage since it contains only 16 per cent phosphoric acid as opposed to pyrolytic phosphate which contains as high as 40 or 50 per cent.

Moreover, it is necessary to prepare a fertilizer material which will yield the greatest net return per acre. Shall it be acid phosphate, pyrolytic phosphate, double super-phosphate, or a combination of phosphorus with potash or nitrogen, or both? Which form of fertilizer will yield the greatest net return over cost? All these questions must be answered before a western fertilizer industry can be built up. A vast amount of research, both economic and technical, is necessary to throw additional light upon the questions suggested above. And little experimental work has been done.

The work of the Pennsylvania Experiment Station throws some light on the subject.[3] The results of forty years' experimental work are reported, in part, as follows:

1. "Phosphoric acid is the first limiting factor in this soil and until this element is supplied nitrogen and potash give little increase in yields.

2. "Potash alone has increased yields only slightly, but when added to phosphoric acid has given a large increase over phosphoric acid alone.

3. "Phosphoric acid and potash without any nitrogen have given a greater net return than any of the combinations including nitrogen and have practically maintained the fertility for forty years. This is in a rotation including clover once in four years.

4. "Nitrogen . . . has not given profitable increases in yields of crops when used alone or in any fertilizer combination."

If it is found to be generally true, as seems to be the case in Pennsylvania, that a combination of phosphorus and potash yield the greatest net return, the question of available sources of potash is raised, and the cost of this material must be reckoned in the production of a fertilizer.

The ultimate object of promoting a fertilizer industry is to increase the food production of the arable land of the United States. This will come about only when farmers find it profitable to do so. A high-cost fertilizer will mean that the day of their use will be postponed until the price of breadstuffs has risen considerably. On the other hand, any efforts that tend to lower the cost of fertilizers, by improved technical processes, by economies in distribution, and by scientific application to the soil, will tend to increase food supply without much greater increase in cost. This is a desirable condition and merits the best efforts of all parties connected, directly or indirectly, with the fertilizer industry. Not only this, but the United States, with its immense phosphate reserves,

[3] "Forty Years' Results With Fertilizers," *General Fertilizers Experiments, Bull. 175*, Pennsylvania Agricultural College.

may have to become an important food producer for less favored nations (Fig. 6).

THE CONSERVATION OF PHOSPHATES

Because of the vital importance of phosphorus in maintaining a high agricultural production, it is only prudent to examine the relation of demand to total supply of the material in order to determine the possibility of exhaustion. Disregarding the total world supply and confining our attention to the deposits within the boundaries of the United States, one finds from the reports of the U. S. Geological Survey that the reserve approximates 6,000,000,000 tons.[4] If the present consumption of approximately 3,000,000 tons is maintained, the reserve would be exhausted within 2,000 years. Two factors, however, may act to change the rate of production in the United States. The opening and development of the rich deposits in northern Africa will tend to diminish exports from this country. Also, it is likely that methods of profitably extracting phosphorus from sewage will be developed.

At the present time, the average annual application of fertilizers in pounds per acre of land in crops in various countries is as follows:[5]

	Pounds
Germany	188
Great Britain	162
France	79
Italy	77
United States	40

The table shows that its use in the United States is slight as compared with the countries of western Europe. Any predictions as to the rate of application that will be reached eventually in the United States are valueless further than that a considerable increase may be expected. The net result is that the consumption of phosphate rock will grow to much larger proportions than at the present time.

With this in view, it seems clear that in the interest of the future generations reasonable efforts for the conservation of the material should be made by the present generation. It is not to be expected that consumption to meet present needs be curtailed for future interests.

FIGURE 6.—The terrane in which the Florida deposits of phosphate rock are found. (Courtesy of the U. S. Geological Survey.)

Rather, consumption should be increased just as rapidly as possible to keep up the productivity of the better grades of lands and thus insure an adequate food supply for an ever increasing population without a great increase in cost. Nevertheless, certain conservational measures are feasible and with proper encouragement can be put into effect without throwing additional burdens upon the present. Before discussing the conservation measures that are applicable, it may be well to summarize briefly the wastes that are occurring in phosphate production. They are:

[4] U. S. Geological Survey.

[5] *American Fertilizer* 55, 4, August 13, 1921.

1. LOSSES THROUGH WASTEFUL METHODS OF MINING

In the mining and preparation of acid phosphate it is necessary to secure a raw material of fairly uniform grade and relatively free from iron and aluminum oxides and silica. In the Florida pebble phosphate beds which are imbedded in a matrix of sand, clay, and soft phosphate, the washing process removes, it is conservatively estimated, 50 per cent of the finely divided soft rock phosphate which goes into the dump heap and is lost. In some cases this loss runs as high as 85 per cent. No method has yet been found which will mechanically separate the sand and clay from the soft phosphates. The loss seems to be unavoidable so long as the method of preparing the fertilizer by the treatment of sulphuric acid is used. There has been experimental work going on with the view of preparing a pyrolytic fertilizer which will be able to use the low grade rock now unsuitable for the acid process. This will be a distinct step in conserving phosphates.

2. LOSSES BY LEACHING OF BARNYARD MANURE

There is produced annually as a by-product of the live-stock industry a large quantity of barnyard manure. A ton of this manure of average composition contains approximately five pounds of phosphoric acid. Few farmers have the facilities for properly conserving manure and, on farms where cattle are kept in barns for a considerable part of the year, and where the manure accumulates, the loss by leaching and erosion must be large, although it cannot be quantitatively estimated. This could be prevented to a large extent.

3. LOSSES OF PHOSPHORUS IN SEWAGE

Under the present system of sewage disposal, all of the phosphorus contained in this waste product is lost. "It is estimated by Whitson that the loss of phosphoric acid in city sewage is the equivalent of at least 1,200,000 tons of high grade phosphate rock." [6] The phosphorus of sewage can be saved either by direct use of the material or the separation of the phosphorus by some method yet to be developed. It is by conducting researches on problems such as this that governmental agencies can coöperate with industry in promoting the desired ends.

The present status of the phosphate industry suggests that conservation can be most effectively promoted by conducting researches in cheaper and at the same time more effective methods of extraction. In fact the Bureau of Soils is engaged in this kind of work. But what seems to be a more important aspect of conservation is the need of cheapening fertilizer production to provide against the day when the limited area of fertile land will be called upon to produce far more food than it is now producing. A shortage of food may occur on account of limited land supply far sooner than on account of the exhaustion of phosphorus, and it is only the part of wisdom that by a liberal consumption of phosphates tending to increase the economic supply of land, the food supply can be made as great as possible.

[6] Van Hise, C. R.: *Conservation of Natural Resources*, p. 327.

TRADING WITH THE TROPICS

E. S. Gregg

Chief Transportation Division, U. S. Department of Commerce

TRADING with the tropics is regarded by the American layman as not essentially different from trading with Milwaukee or Hoboken. His knowledge of foreign lands is generally limited to ideas gathered from postage stamps collected in his boyhood, from the colorful posters of steamship companies, or from hazy recollections of his elementary grade-school geography. Only the geographer, the traveler, or the experienced business man, realizes that the specialized methods and equipment for tropical trade necessitated by the climatic conditions of low latitudes, are quite unlike those required in the trade of temperate lands (Fig. 1).

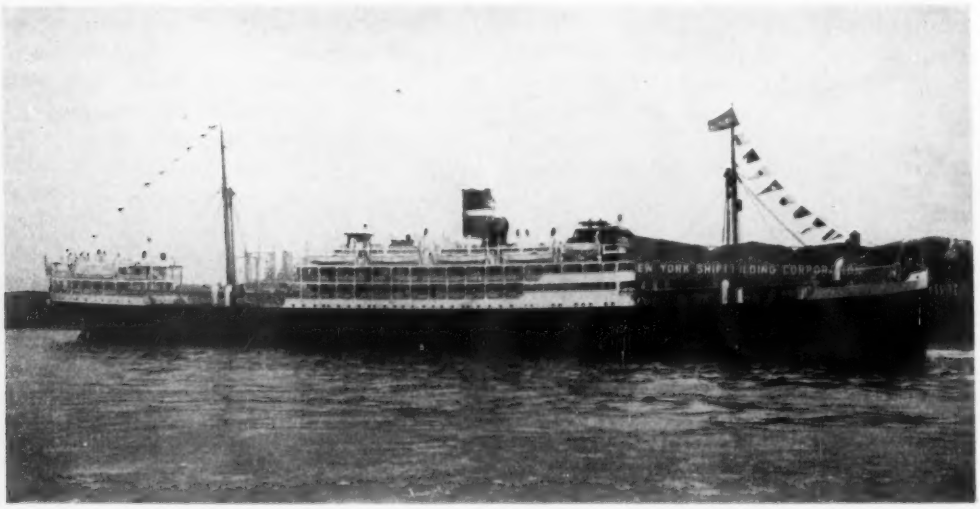

FIGURE 1.—A combination passenger-cargo ship designed especially for trade with the West Indies and tropical America. (Courtesy of New York Shipbuilding Corporation, Camden, N. J.)

A discussion of this specialization in technique to meet the extra hazards of tropical weather should logically start with the basic fact that in our country an advanced state of industrial development has been achieved and in the tropics it has not. The reasons for this difference are basically geographic. In the United States are found in large quantities fuel and raw materials. An invigorating climate stimulates mental and physical endeavor. The absence of these factors in the tropics results in the production of things outdoors with a minimum of effort. It is true that in the countries bordering on the Caribbean there are highlands where the temperature and rainfall approximate those in sections of this country. Further, fuel for industrial uses is abundant in some of these countries. In the future, efficient transportation may make it possible for raw materials to be brought to the fuel, so that industries may spring up in these high regions. But in the near future it is probable that no pronounced industrial development will occur in the Caribbean.

This statement is in line with the conclusions of geographers who point out that industrialism has always moved in an east and west direction. Eventually

it may be true that all countries in the temperate zones will reach a degree of industrialization approximately equal. But it is highly improbable that industrialism will ever move north and south. Tropical countries will doubtless always be largely agricultural. They are fitted by nature for such a development. This difference in development between temperate and tropical countries determines that the southbound cargo from this country shall be largely manufactures and the northbound movement largely raw materials and food products.

A few figures will demonstrate the correctness of this statement. Of a total southbound movement from this country to the Caribbean area (West Indies, Mexico, Central America and the northern part of South America) of 5,725,000 long tons, only 1,255,000 tons, or 22 per cent were of raw materials. Coal and coke comprised 80 per cent of these materials and the grains accounted for most of the rest. The northbound movement to this country is strikingly different. Of a 21,030,000 ton total, 13,957,000 tons are of oil, 2,995,000 tons sugar, 1,029,000 tons bananas, 849,000 tons molasses, 549,000 tons iron ore, and 215,000 tons coffee. Over 93 per cent of the total exports of this area to the United States is made up of these seven articles, of which only molasses goes through a minor manufacturing process.

The first obvious fact about our trade with tropical America is that special types of ships are necessary. In general the vessels in the trade between the Caribbean area and this country may be roughly divided into three classes: tramp ships, oil ships, passenger ships, and fruit ships.

Little attention need be paid in this paper to the tankers which carry oil in bulk. It is fortuitous that large pools of oil are found in the tropics. Geologic rather than geographic factors make this the case. Tank ships are a highly specialized type capable of carrying bulk oil (Fig. 2). While some supplies are carried to the oil fields in the "'tween decks" of tankers, the goods so carried are a small percentage of our total trade with this region and can be disregarded at this time. It should be pointed out, however, that in no trade region are tankers so numerous as in the Gulf of Mexico.

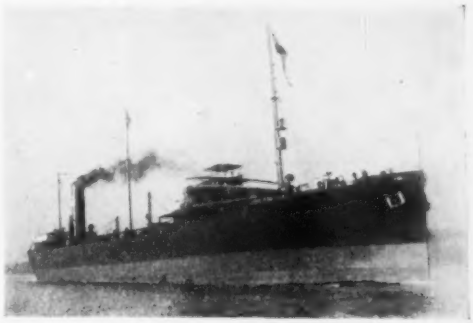

FIGURE 2.—A tanker for carrying oil in bulk. Because the consumption of oil in the United States exceeds production and the main extra sources are overseas, this country has the largest fleet of tank ships in the world. (Courtesy of New York Shipbuilding Corporation, Camden, N. J.)

The tramp ship is engaged in the bulk cargo trades of the world. It follows no regular itinerary and keeps no fixed schedules. Such vessels are chartered in large quantities to move the sugar crop of Cuba and the West Indies and to carry our coal and a part of our lumber southward (Fig. 3). For a few months they are in this trade and then the demands of other seasonal crops call them to the Argentine, Australia, Java, or other remote regions.

Passenger ships are scarcely a distinct type in the Caribbean trade because the fruit ships and even the cargo vessels carry passengers; nevertheless several lines of passenger ships are in operation in this region. In addition to passengers these ships carry the higher class of package cargo.

The effect of geographic factors on tropical shipping is seen most clearly in the fruit ships. These vessels have a value for our trade in excess of their numbers. They maintain regular communications with our small neighbors to the south. Carrying mail and passengers,

they make possible a constant exchange of ideas and business details. They give an assured outlet for the tropical produce of the Caribbean and make it possible for

FIGURE 3.—Small cargo vessel at dock in Paramaribo, D. G. Facilities at most tropical ports are poor and costs of handling cargo are high.

northern articles to be obtained in exchange.

The first essential point to notice about a fruit ship is that it costs more than an ordinary cargo ship. This higher cost results from higher speed and refrigeration apparatus. The economic speed of a fruit carrier is different from that of a non-refrigerated vessel, because the capital expenditure on the fruit ship is around 40 per cent above that on a cargo ship. This increased original cost requires a higher sea speed with facilities for rapid turnaround in port, if an equal earning capacity per unit of capital invested is to be obtained. The other alternative is that higher rates be charged. In practice a combination results, the average fruit ship is several knots faster than a cargo ship and rates between this country and the Caribbean area are high in relation to the distance.

The interior of a fruit ship must be entirely insulated. Machinery must be installed to keep the temperature in the holds between 53 and 55 degrees. Provision must be made for heating the holds in northern waters during the winter months. These precautions are against a decidedly geographic element. As a result of these necessities, the fruit carrier has a smaller deadweight carrying capacity than a non-frigerated ship and all these factors make for the higher initial construction cost of ships of this type. Bananas sometimes are carried in ordinary cargo vessels in the "'tween decks." This practice results from an insufficiency of regular fruit ships for peak movements (Fig. 4).

Because of the premium on rapid loading of bananas—partly due to the higher cost of the ship and partly to the nature of the cargo—an interesting minor structural change is made in fruit ships. Large hatches are not required for the handling of fruit, and fruit ships generally have a number of small hatches and even side ports. In this way the need for rapid loading and discharging is met. The cargo is handled a minimum number of times. The operation of multiple labor units is possible.

FIGURE 4.—Loading bananas from lighters at a small Cuban port. Because of the high cost of refrigerated vessels many "'tween decks" cargo ships are now used to carry bananas from ports where the run is only four or five days.

Another interesting fact may be noted. Bananas, which form the larger part of the northbound cargo from the Caribbean

stow about 150 cubic feet to the long ton. Ocean freight rates are usually made on the basis of 40 cubic feet to the ton and most cargo ships are built on the basis of about 55 to 60 cubic feet of space for a long ton of cargo. While most of the articles shipped south would take a measurement rate, *i.e.*, would stow more than 40 cubic feet to the ton, a limit is placed either on the south bound or the northbound load of the ship, depending on which movement is considered the most important, and dictates the design of the ship. The northbound movement, of course largely controls the design.

FIGURE 5.—Dock at Georgetown, B. G. Note flimsy construction and antiquated crane, reasons why freight rates are high to ports of this kind.

A fact, frequently discussed, is that ocean freight rates from this country to the Caribbean area are unusually high in relation to the distance. The rate on machinery from New York to La Guaira, Venezuela, 1,847 miles, was at the end of 1924, $14.56 a long ton as compared with $12.00 to Calcutta, India, 9,816 miles, $12.00 to Ceylon, 8,607 miles, $12.00 to Bombay, 8,174 miles, $9.00 to Capetown, South Africa, 6,786 miles, $12.25 to Rio de Janeiro, 4,770 miles and $10.00 to Barcelona, 3,719 miles. The distance from New York to these ports is over twice that to La Guaira and yet the freight rates in every instance are less. The relation between these rates is characteristic of the relation between rates on automobiles, agricultural implements, general cargo, etc. The explanations usually given for the higher rates in the Caribbean trade include reference to lack of competition, strong conference agreements, inadequate harbors, poor harbor facilities (Fig. 5), large expenses for loading and unloading cargo, etc. While all these factors have a bearing on the case, the important factor of higher construction cost of the ships in this specialized trade is never mentioned. As has been pointed out, this higher cost of the ship, partly compensated for by highe

and special design for rapid turnaround in port, is also partly compensated for by higher ocean freight rates. This point bears out the earlier statement that geographic elements make transportation between this country and the tropics a more costly business than in most temperate trades.

All these facts are concrete evidence that geographic factors vitally affect the character of the ships which perform the most important part in our business connections with our neighbors to the south. These facts have implications beyond the confines of this article such as ease of maintaining conference ocean rate agreements, the more profitable operation of ships under the American flag in this trade because the banana business is integrated, and the like.

The second interesting fact about our trading with the tropics is that it costs our traders more to get their goods ready for the Caribbean markets. The most important necessities are to protect the cargo from excessive moisture due to external causes, *i.e.*, rain or waves of the sea, and from internal moisture, so-called "sweating" caused by heat and insufficient ventilation.

Our traders in packing goods for shipment to the tropics, have to pack them not only against the rough handling they will receive enroute but especially against the climatic conditions they will encounter. Most commodities are damaged by moisture. Textiles are discolored and decayed; metals and machinery are rusted; foodstuffs are made unpalatable; chemicals are dissolved or changed in composition; even canned goods may have their labels discolored or separated from the cans and as a consequence become largely unsalable.

Protection from external moisture is usually obtained by metal lining, hermetically sealed by waterproof paper, and by slushing compounds. It is evident that metal-lined cases are quite expensive. The buyer can afford to have only high-priced goods packed in this [illegible] Such cases, of course, are much stronger than cases with only waterproof paper lining, and they are absolutely waterproof, even when immersed in water.

For most articles other than machinery or metals, protection from external moisture in the tropics is obtained by the use of waterproof paper. Most paper of this description is made of two sheets of sulphate kraft paper, cemented together with a layer of asphaltum. This kind of paper is suitable for case and crate linings. Cloth-reinforced asphaltum paper is frequently used for case-linings and also for bundles and bales. It is practically moisture and puncture proof. Burlap-reinforced asphaltum kraft paper has great strength and offers the most resistance to abrasion. Waterproof material of the latter varieties should have all joints asphalted; the result is to make the package practically air-tight.

It is essential for the bright parts of machinery to be protected from rust. All shipments of such articles to the tropics are certain to be subjected to rain and perhaps also to salt water. Usually the bright parts of machinery are of such composition as not to allow the application of metallic coatings, such as galvanizing or vitreous enamels, paints or varnishes. These substances form dry, hard films, not easily removed. A compound is required that will keep out all dampness and that will have such properties as to prevent running off under adverse climatic conditions. Protective coatings to prevent metals from corrosion are called slushing compounds.

Slushing compounds are of various natures. Sometimes they are straight mineral greases, such as petrolatum. Sometimes they are mixtures of mineral and animal greases, with or without the addition of soap, such as lime rosin or lime fatty acid soaps, finely divided mineral matter and volatile oils. Sometimes the petroleum base is mixed with rosin or rosin oils.

One of the primary requirements of a slushing material is that it can be easily removed when desired and yet has suffi-

cient body to withstand rubbing. An ideal slushing compound is one which can be easily applied to all kinds of metal surfaces by a variety of methods, which coats the surface with a film sufficiently thick to exclude moisture and air, which remains in position an indefinite time, and which is completely removable without undue labor or damage to the surface.

These details emphasize with considerable force the influence of geographic factors on specialization in trading with the tropics. Because of these geographic factors certain industries are kept busy manufacturing articles to overcome them and exporters are required to give more care to their shipments to tropical regions. It is obvious that goods are not well packed if they do not reach the buyer in good condition. Claims for damage in transit are an economic waste. Goods received in poor condition mean the loss of an expected profit to the buyer. Proper packing of articles is essential to a successful export trade. When goods are destined for the tropics, exporters must not only put into practice the sound principles of crate or box construction, but must effectively combat the extra hazards incident to tropical climate.

No new ideas on the subject of trading with the tropics have been presented, but emphasis is placed upon the importance of facts already well known by a listing of semitechnical details. If geographers give more attention to the details which confront the business man in attempting to overcome geographic factors which make his trading operations more expensive, a great service will be rendered. The business man is too apt to say that scientists talk only in general terms. All the issues which he must meet, however, are specific ones. Hence, there is need for the popularization of geographic principles by application to detail.

FIGURE 6.—The technique of handling bananas is highly perfected. If all the trade with the tropics were as well organized as the trade in bananas and other tropical fruits, little complaint would be heard regarding difficulties, and more satisfaction would be expressed over profits.

BOOK REVIEWS

Publications of the Bureau of Foreign and Domestic Commerce of Value to the Geographer

Commerce Year Book, 1924.

This volume contains information of unusual significance to the geographer. The first part deals with commodities moving in foreign trade. A section is devoted to the discussion of foreign trade of the United States, its general movement, geographic distribution, trade by great economic classes, trade by commodity groups, and the relation of exports to production. Another chapter analyzes the international trade of the world for 1924, while the last portion of the book presents economic conditions for the principal countries of the world during 1924. Carefully selected and pertinent statistical data illustrated by appropriate graphs and maps add value to the book. This one small volume in fact forms a valuable reference book for University work or for the business man. It may be obtained from the Superintendent of Documents for $1.00.

Statistical Abstract of the United States, 1924.

For general statistical information of all sorts there is no more compact reference. The geographer needs facts on which to base his analyses and conclusions. The statistical abstract combines in one small volume a wide range of material. It is gathered from the U. S. Census, from the Geological Survey, and from many other official, as well as commercial sources. Not every geographer can have the entire United States census at his elbow or even the abstract, nor is it possible for him to obtain statistical reports from all government departments and many large business firms, but through the statistical abstract he has direct access to the most significant data and will find considerable help in utilizing it as a reference.

Foreign Trade Bulletins.

The Bureau has just issued a new list of publications. It contains everything published to May, 1925, and may be obtained by writing to the Bureau of Foreign and Domestic Commerce.

Railways of Central America and the West Indies, by W. Rodney Long. Price, 70 cents.

Information regarding both the countries and the transportation systems of Central America and the West Indies is not always easy to find. This recent trade promotion bulletin gives not only facts and statistical material but maps showing the general railroad routes; it also contains brief descriptions of the countries included in the area.

Motor Roads in Latin America, Trade Promotion Series No. 18, by Frank B. Curran of the Transportation Division. Price, 50 cents.

This is a valuable companion volume to the Railways of Central America and the West Indies. It presents road conditions for the principal highways of all Latin America, and maps for each country locating the principal motor highways. The descriptions are clearly written and altogether the volume contains much information which is often difficult for the geographer to find.

World Trade in Gasoline, Trade Promotion Series No. 20, by Homer S. Fox of the Minerals Division. Price, 15 cents.

Petroleum and gasoline have attained an important position in economic activities of the nations. This bulletin presents in compact form the principal statistical and other facts regarding international trade in these products and deals as well with production of petroleum.

The French Lumber Market, Trade Promotion Series No. 19, by Axel H. Oxholm, Chief of the Lumber Division. Price, 65 cents.

In a comprehensive manner this volume deals with important aspects of the French lumber market. The forest resources of France are presented in an interesting and satisfactory manner, while some attention is given to the forest resources of the several French colonies. The principal part of the book is devoted to the French lumber industry.

French woods are described, the import and export market analyzed, and the extent and type of demand discussed in detail. The appendices contain statistics of the French lumber trade and an English-French vocabulary.

Commercial Survey of the Philadelphia Marketing Area, by J. Frederic Dewhurst, Domestic Commerce Series No. 1, issued by Domestic Commerce Division. Price, 20 cents.

The Domestic Commerce Division is undertaking a series of commercial surveys for various parts of the country, and this is the first to be issued. Maps and graphs, as well as statistics, lend point to the text. The relation of raw materials to manufactures is well discussed, and the importance of the Philadelphia region as a marketing area analyzed in detail. One section of the report gives a general geographical survey of the entire Philadelphia area.

Possibilities for Para Rubber Production in the Philippine Islands, Trade Promotion Series No. 17. Price, 20 cents.

A survey of essential raw materials was authorized by the 67th Congress and this bulletin contains the report of field studies made in the Philippine Islands, with a view to determining their possibilities for rubber production It incidentally presents an excellent picture of the various islands, their surface, topography, rainfall, vegetation, and plantation development.

International Trade in Machinery Belting, E. C. HOLT of the Rubber Division. Price, 15 cents.

The title of this bulletin might imply that it was of interest simply to the person concerned with trade in the one commodity. It, however, contains excellent pictures of industrial conditions in the various countries which use this product and consequently has general as well as specific value.

Investments in Argentina, by FREDERIC M. HALSEY and G. BUTLER SHERWELL, of the Finance and Investment Division. Price, 10 cents.

No better picture of business conditions and development in Argentina can be obtained than through this analysis of investment conditions in that country. From a general picture of the country itself, the authors pass on to a discussion of foreign investment there and the type of development which is at present occurring. The bulletin in fact provides excellent material for the geographer who wishes to discover how the people of Argentina are utilizing the resources of their natural environment.

Iron and Alloy Metals in Siberia, by BORIS BAIEVSKY of the European Division. Price, 10 cents.

Siberia is a country about which little specific information is available. This bulletin presents only a small portion of the results of extensive research. Maps are used to picture the distribution of iron deposits and the text explains them in considerable detail.

Foreign Trade of the United States for the Fiscal Years 1924–25, prepared in the Division of Statistical Research. Price, 10 cents.

This is the annual summary of the foreign trade of the United States and contains both text and statistical material of considerable value.

The foreign trade of the United States is such an important factor in its economic life and development that every up-to-date contribution is of interest and value, not only to the geographer, but to the whole public.

All of the above publications may be obtained from the Superintendent of Documents, Washington, D. C.

HELEN M. STRONG.

SHANTZ, H. L., and ZON, RAPHAEL. *Natural Vegetation*. 29 pp.; maps, tables, charts, ills., and bibliography. Being Section E, Part I, The Physical Basis of Agriculture, of the *Atlas of American Agriculture*, prepared under the supervision of O. E. Baker, Agricultural Economist, Bureau of Agricultural Economics, H. C. Taylor, Chief, United States Department of Agriculture. Government Printing Office, Washington, D. C.

This latest section of the *Atlas of American Agriculture* continues the admirable series, begun several years ago, of such inestimable value, not only to the farmers of the country, but to the thousands of scientists and workers in fields related to agriculture, of which geography is one. It constitutes the most accurate, and most authentic, statement of the vegetation of the United States ever prepared. While not all plant geographers and ecologists would agree with the natural vegetation regions as herein defined and delimited, probably nearly all would concede the general excellence of the work done, and the success of the authors and their associates in presenting clearly, yet in compact form, the essential facts and the significant relationships of the larger plant associations.

H. L. Shantz, Physiologist, Bureau of Plant Industry, contributes the portions of the section devoted to "Grassland and Desert Shrub." With characteristic thoroughness he has winnowed the facts that he himself has garnered over many years of exploration and study in the field, and those that he has gleaned from the researches of others, so that the ten pages of text devoted to these two extensive subjects include the salient, fundamental information, so necessary to the continuation of the research to which this knowledge is prerequisite. Briefly, but most clearly, the major distinctive grassland and desert shrub types of vegetation are described, their relationship to the physical environment explained, and their significance to agricultural development pointed out.

Raphael Zon, Forest Economist, Forest Service, with equal clarity and equal brevity has done for the "Forests" the same selective task that Mr. Shantz has done for the "Grasslands and Desert Shrub Regions." The student in forestry, the lumberman, and the worker in related industry and research, will all be grateful to Mr. Zon for his classifications and descriptions of the major forest types.

To the many workers who have helped liberally, and who have given freely of advice and suggestion, both these men give due and generous credit and recognition, not only by special reference, but in the relevant bibliography that closes the work. They also insist that their work is merely preliminary and that they present it in the hope, and confident in the assurance, that other workers may use it to advantage in this work that they outline.

The climactic feature of the section is the excellent map of the natural vegetation which forms an essential part of the work. Most graphically it presents the area, the extent, and the limits, of the regions described in the text, and indicates their relation to the land mass and its physical variations. The authors point out that as knowledge of the regions becomes richer and more exact, many corrections and refinements can be made, which are not possible in this first generalization for so large a territory.

It is unfortunate that the edition of this very excellent and valuable publication has been so limited that its distribution has been necessarily curtailed, and thus the section denied to many a worker who might most profitably use it. It is an unsound and unsafe governmental policy of economy unduly to restrict by limited issue the popular use of any part of such a valuable series as the *Atlas of American Agriculture*, to which some of the best minds in American science have given years of their best thought and research.

The Department of Agriculture and the men who have been active in the project deserve the gratitude of scientists everywhere for planning this whole admirable series, and the congratulations of our whole people on a work so well done.

W. ELMER EKBLAW

THOMAS, FRANKLIN. *The Environmental Basis of Society: A Study in the History of Sociological Theory.* vi and 336 pp.; bibliography and index. The Century Company, 1925. 9 x 6 inches.

In his *Environmental Basis of Society* Professor Thomas has produced a book which will be welcomed both by sociologists and geographers. Its purpose, as stated in the preface, "is to present, in their appropriate historical and cultural settings, theories which attempt to explain the phenomena of individual and social life in terms of the geographic environment. It is not a study of environmental influences but of theories, ancient and modern, which deal with these influences. In a later chapter some of the more important criticisms of environmental doctrines are presented and evaluated, but the fundamental aim of the study is accurately to expound the doctrines rather than to pass judgment upon their scientific validity."

The author is gifted with the power of clear, succinct statement. He has performed his task with thoroughness, care, and every intention of making a fair presentation of the theories under discussion; but at times by implication he ascribes the expression "geographic control" or "geographically determined" to geographers who have studiously avoided these uncompromising terms, and have purposely employed less inclusive terms, such as geographic factors, geographic influences, adjustment to the environment, adaptation or response to geographic conditions, utilization of geographic opportunities, or the geographic line of least resistance. Critical comments, occasionally thrown in by the author, add greatly to the value of the book. Such is his criticism of Dexter's conclusions as to human behavior under a combination of weather conditions which in reality rarely coexist or are mutually exclusive. Occasionally these criticisms, legitimate though they be, do not penetrate to the ultimate geographic factor involved. For instance, Leffingwell, on the basis of statistical investigations, reached the conclusion that an increased excitability of the human nervous system during the spring and summer, induced possibly by the gradual increase of solar light and solar heat, is responsible for a synchronous increase of insanity, crimes against person, rape, illicit sex relations resulting in illegitimate births and other phenomena. Commenting on this conclusion, Professor Thomas holds that Leffingwell "makes practically no allowance for the social factors involved. He fails to note that summer allows greater freedom of movement and social contact, and hence greater opportunity for and temptation to crimes against the person. The fact that the sexes are thrown together more in the summer than in the winter, and with less supervision, is doubtless a factor in the increase of rape and of illegitimate conception." The exception is well taken; but the geographer would say that, instead of the "social factor" of Professor Thomas, we have to do here with an indirect social effect of the summer weather reinforcing the direct physical effect of the solar light and heat.

The chapter on the "Critics of Geographic Determinism" is provocative of thought, despite the fact that the criticisms are directed against "the exponents of pure geographic determinism," a group which includes few recent geographers. Most of the critics derived their earliest and most lasting impressions of anthropogeography from Ritter's teleological conception of earth and man, from Buchle's rather fanciful generalizations as to the mental effects of the "Aspect of Nature," and Montesquieu's ill-founded conclusions as to the influences of climate, all of which are now discarded. Yet, rarely does a critic fail to make a target of Buchle and Montesquieu: it is so easy. One method of the critics is to single out a particular geographic factor, usually climate, and ignoring all other contributing geographic factors, arrive without impediment at a dramatic *reductio ad absurdum*. All the sociologists admit some degree of influence due to natural environment, but each limits this influence at some arbitrary line of his own. One acknowledges the important influence of environment upon the forms of human inventions, and another exempts inventions from any such effect. The critics write in asserting that the problem of "geographic determinants" (*sic*) is not so simple as the geographers represent. As a matter of fact, none are so aware of the profound complexity of the problem as the geographers themselves.

A further charge claims that geographers ignore the psychic factor in cultural and social evolution, though they deal with men as sentient, purposive beings, responding to the stimuli of their environment. Professor E. A. Ross states that many phases of economic and social activity, such as migrations, colonizations, lines of communication and currents of trade, "have human volitions as their proximate causes and not the features of the physical environment. . . . It is only when, pressing further back, we undertake to account for their purposes that we come upon considerations relating to climate, soil, water, timber and the like. Similarly a railway net has all its causes in the volition of the men who had it built. The topography of the country enters into the case only as affecting the motives that determine these volitions." Yet psychologists tell us that a volition translates itself into action only under the stimulus of an adequate motive or purpose or desire. Professor Ross, therefore, making volition superior to geographic influences but motives subject to them, comments: "It is a dim recognition of this distinction that leads most writers to speak of the physical environment as influence rather than cause. Undoubtedly men's choices are conditioned and their projects limited by the physical framework they live in." And this is all that geographers claim. They use the term influences or factors or conditions because they recognize the complexity of motives underlying the final act of volition, and expecially the varying degree of motivation necessary to overcome inertia and translate purpose into action.

Discussing the acknowledged effects of a radical change of environment upon a people, Professor Ross considers that "the chief transforming factor is not climate or aspect of nature working directly on people, but radical change of occupation, working first on habits and ideas, and then on social relationships and institutions." In the first clause Professor Ross harks back to those same old ideas of Montesquieu and Buchle; in the second, he fails to recognize the radical change of occupation as an economic effect of the new environment, producing in turn modified social institutions.

Professor Thomas fails to evaluate adequately the criticisms incorporated in this chapter, and thus somewhat mars an otherwise admirable book.

ELLEN CHURCHILL SEMPLE.

GREELY, MAJOR GENERAL A. W. *Handbook of Alaska: Its Resources, Products, and Attractions.* xi and 330 pp.; maps, tables, ills., and index. Charles Scribner's Sons, New York, 1925. $3.50. 8 x 6 inches.

Revised to 1924, General Greely's *Handbook of Alaska* resumes the place it long occupied as the most authentic and comprehensive compendium of geographic knowledge of Alaska extant. Two thirds of the revision is new material, and all the old material retained has been brought up to date, and reset. More definitely than ever it becomes the standard reference work on this northern empire of the United States.

The book opens with a general geographic description of the entire territory, well written but all too brief. This is followed by a chapter on government and laws; and then follow thirty-odd chapters on the physical environment, the various regions, the resources and the industries, the inhabitants and their culture, and sundry incidental but important subjects, ending with a chapter on products, actual and potential, all replete with a multiplicity of facts, compacted most skillfully within the confines of the relatively few pages allocated to each.

The regional chapters, ten in number, and the chapters on industries, also ten in number, contain a wealth of valuable information, and are particularly serviceable to the economic geographer. The regions are not necessarily distinguished by homogeneity or similarity of characteristics but though apparently chosen chiefly because of convenience they do display certain definite natural bases of selection. The chapters on industries are frankly summaries. They might be expanded by a mass of detail, but without good reason in a book of this kind.

The only serious criticism that could justly be made is of the sequence of chapters. It would seem that the succession could be better, though the author probably had good reasons for his sequence. Thus the chapter on "Climate" is sandwiched in between "Government and Laws" and "The Army in Alaska"; "Glacier Regions" is the filling between "Agriculture, Forestry, and Homesteads" and "Reindeer"; and nine chapters, chiefly on industries, are interposed between the first five chapters on the mainland regions and the two regional chapters on the "Alaska Peninsula and Kodiak" and "The Aleutian Islands." The chapters lose some of their interest and the book part of its value by this separation of related subjects; the reader loses that continuity of effect so necessary to the good picture of the land.

As a whole however the book is admirable, a credit to the veteran author who has these many years been the dean of our American authorities on matters Arctic, not only by virtue of years of study, but because of even more years of experience in Arctic exploration and in military administration of Alaska's affairs. He has been eye-witness to the extraordinary progress made from "Seward's polar-bear garden" to the prosperous commonwealth of our day, with its hopeful future of increasing industry and growing population. His years have been long in the land, and this book, coming from his hand well after he has passed his eightieth birthday, bears witness to the inexhaustible virility and sturdy vigor of the man.

W. ELMER EKBLAW.

JAMES, HERMAN G. *Brazil After a Century of Independence.* xii and 587 pp.; ills., maps, and index. The MacMillan Company, New York. 1925. 9 x 6 inches.

Brazil After a Century of Independence, by James, constitutes a wealth of historical and geographical information on a country of large resources and one of the most interesting commonwealths of South America.

In the initial chapter, "Physiography," the author treats the extent of Brazil in a sketchy manner, describes the coast line in some detail, relates the political events by which the international boundaries were established, devotes three pages to topography, nine to rivers, and three each to mountains, climate and geology. There is little in the way of salient physiographic interpretation. The whole chapter impresses one as a collection of unrelated facts thrown together under the heading of "Physiography."

In pages 43 to 123 the author disregards the title of the book, *Brazil After a Century of Independence*, and discusses in considerable detail (1) the development and separation of Spain and Portugal, the division of America between these two countries, the early explorations in Brazil, the establishment and failure of the Feudal Captaincies, (2) the intricate exigencies of the long colonial period from the advent of Thome de Sousa as first governor general in 1549 to the year 1808 when Prince John of Portugal transferred the Portuguese Court to Brazil, thus in effect reversing the positions of mother country and dependency, and (3) the troubled reign of Dom João VI in Brazil, 1808–21, and the conditions bringing about independence.

One hundred pages are devoted to an historical analysis of the reigns of Dom Pedro I and II, and to the condition leading to the establishments of the Federal Republic and the present governmental system. This analysis gives a clear and concise presentation of the federal government, the several state governments and their relationships.

The remaining two thirds of the volume constitute a mine of general information on the wealth of the country—the natural resources, the cosmopolitan population, the varied industries and their distribution, the transportation facilities, foreign commerce and social conditions. In this discussion the author throws into relief the great problems facing the country—the population question, and the problems of tropical diseases and tropical sanitation. It is to be regretted that this section so rich in factual content is so inadequately illustrated with maps, diagrams, and pictures. Only three small one-page black and white maps appear in the book—physical, economic, and political. The economic map is of little value; on it cattle seem to be of equal importance over all Brazil except the Amazonian Basin; rubber is indicated as being as important north of the lower Amazon as along the Madeira. As a matter of fact, the principal rubber tree, Hevea Braziliensis, is not found to any extent north of the lower Amazon.

Considerable space is devoted to the distribution of the different crops and industries, yet it is difficult for the reader to get a clear picture of the importance of these in various regions. Far more could have been told clearly and in much less space by a few well prepared maps and diagrams. Furthermore the volume is illustrated with only inferior photographs. It is difficult to believe that eight pictures which would show less or as little about the economic or geographic conditions of the country could be selected.

A valuable part of the volume is the informative discussion of the 22 individual states, but the unattractive alphabetical order and the encyclopaedic method employed detract from the excellent factual material embodied in the treatment. Furthermore, in the attempt to portray the area and population of the states, so as "to permit of ready comparison with each other and with the states of the American Union," the author, instead of aiding the reader, confuses him. In the comparisons the areas of fourteen different American states are introduced and the population of eighteen, no single state being used more than six times.

A detailed seventeen page index aids materially in opening up this mine of information on Brazil.

CLARENCE F. JONES.

STUCKEY, H. P., and KYLE, EDWIN JACKSON. *Pecan Growing.* xi and 228 pp.; ills., tables. The MacMillan Company, New York. 1925. $3.00. 8 x 5 inches.

The subject of this book is unique in that it deals with the one outstanding native nut tree which has been brought under cultivation and developed to an important commercial extent since the discovery and settlement of North America.

The authors have made a real contribution to American horticulture by making a permanent record of the early history of the activities which led up to the development and establishment of the present commercial pecan industry. They not only point out the territory to which the pecan is indigenous, but show the comparative importance of the several regions in which the nut thrives best in nature. They discuss the relative commercial importance of the pecan as compared with the almond and walnut, the other two nuts, both of which are exotic, which make up the nut production of the United States.

The book gives the stages by which the pecan industry has evolved, discussing the propagation of the trees by nursery methods, pointing out those best adapted to the several purposes, indicating the soil and environmental conditions most congenial to the plant, and discussing what is at present known of the fertilizer requirements of the trees.

The question of pollination, planting, and care of orchards, harvesting, and yields which may be

expected, are discussed, together with a description of methods employed in grading and sizing the pecans for market purposes; as well as conditions under which the crop should be stored; together with mention of the marketing organizations which have contributed to the handling and distribution of the crop.

Like all other important agricultural crops, the pecan is attacked by a considerable number of insect enemies, some of which are of great significance in the success of the industry. The industry has reached proportions which make it important that successful control measures for the handling of important insect enemies be available to cultivators. The book describes various insects, together with the present day methods of treatment. It also gives attention to the Kernel Spot which, in late years, has caused much concern among pecan growers and resulted in considerable loss through affected nuts. The relation which the Stinkbug bears to this trouble is pointed out and the importance of using only certain cover crops which are not attacked by this insect in bearing orchards is made plain.

A chapter is also devoted to recipes for various food products in which pecans make an important contribution; and the book closes with a chapter on the "Botanical Classification of Varieties of the Pecan," with brief descriptions of a number of the more important named sorts.

The book is timely, and one which should be of great value to those engaged in the industry. The historical features of the publication which make available to horticultural students the early history of this important American industry, are of special significance. Many of the individuals who have been actively engaged in the development of the industry are still living, or their work is familiar to associates who knew them well. It frequently happens that such history is neglected until it is difficult or impossible to record. The authors of this book have made a permanent record of the beginning and early development of one of America's promising horticultural industries.

L. C. CORBETT.

MURPHY, ROBERT CUSHMAN. *Bird Islands of Peru.* xii and 362 pp.; ills., diagrams, maps, index. G. P. Putnam's, 1925. 6½ x 9½ inches.

Bird Islands of Peru, by Robert Cushman Murphy, is an impressive and penetrating portrayal of the abundant and teeming life of a thousand miles of desert coast. It is a naturalist's description, exact and vivid, of the long and richly-colored sea-coast of Peru, and its adjacent bird-smothered islands.

In this volume, the sea coast of the Incas lives anew. The importance of the coast of Peru has been obscured by the more pronounced features of the wealth and charm of Highland Peru, where the conspicuous native wonders lie, whether the remnants of a great civilization like the monuments of Cuzco, or the result of crustal movements such as Lake Titicaca, the highest large lake in the world, and the twin peaks Huascaran whose snow-crowned tops reach 6,000 feet beyond the loftiest summits of the Alps; or the rich, gold, silver, and copper mines of which the precious metals led to the exploitation of the once extensive Inca Empire. The coastal region in the fertile valleys of the desert produces in value more than all the mines of Highland Peru.

In comparison with the interior, the appeal of the long shining coast of Peru seems to have been felt only by a few. The casual traveler gazes at the barren cloud-topped ranges and the bold rugged coast with its blistered terraces here and there, and finds only guano, the ammoniacal smell of which strikes his nostrils whenever the steamer draws into the lee of bird inhabited islands. He fails to appreciate the relationship of this valuable guano to the coastal valley agricultural enterprises which contribute in value more than half the exports of the Republic of Peru.

The account of the inter-relationships of the climatic and physiographic conditions, ocean water, fauna, and agricultural operations constitute the chief feature of the book. The author portrays concisely the desert climate and the rugged coast. He interprets, in an illuminating manner, the influence of the Humboldt current upon the unparalleled abundance of a dozen or more groups of sub-tropical or temperate shore fish fauna—the entire Peruvian coast lies well within the tropics—and the resultant myriads of birds which give rise to the important guano industry of Peru. In turn the guano makes possible in the desert coastal valleys the high agricultural development which has been achieved.

The book is the result of a notable piece of field investigation. It carries the reader with the investigator from island to island, all the haunts of millions of birds, and into the out of way places where dwell the maritime Indians in their quaint fishing villages. It is stimulating and fascinating, clearly and simply written, and well illustrated with excellent photographs from the author's collection.

CLARENCE F. JONES.

MEARS, ELIOT GRINNELL, and others. *Modern Turkey.* xvi and 779 pp.; maps, ills., chronology, appendices, bibliography, and index. The MacMillan Co., New York, 1924. 9 x 6 inches.

Though *Modern Turkey* is a compilation of chapters by several different authors, and consequently suffers from lack of homogeneity, and in places from lack of continuity, both in matter and in form, it constitutes one of the most comprehensive of all books in English, available on Turkey, and by far the most valuable on modern Turkey. Within its covers, the student may find practically all the information that he needs for a broad general knowledge of the new Turkish republic and an intelligent appreciation of the economic and political situation within its borders at the present time.

The diversity of authorship has resulted in considerable diversity of style (and, it should be added, of excellence) and of variety of viewpoint, neither undesirable nor unattractive. Though Dr. Mears has apparently edited the copy for the chapters to unify the whole, the individuality of the several authors has not been concealed or suppressed, to the general advantage of the book. A few flagrant typographic errors, and a number of cases of obscure or ambiguous construction, indicate that either the proof-reading or the editing were occasionally done too hurriedly; but though these errors detract somewhat from the general excellence of the book, they do not seriously affect its value.

The geographer, the historian, the economist, and the sociologist, will find a wealth of material in this book, while the general reader will find it interesting, informative, and educational. To the economic geographer, Chapters I and II, and IX to XV inclusive, are of particular value in their rather clear picture of the resources and the industries of the land. The chapter on "Agriculture," by Edward Frederick Nickoley, is most enlightening and might well have been expanded to twice its length without affecting the balance of the book; this chapter and the following chapters on "Forests," by Dr. Mears, and on "Mines," by Jemal Bey, portray rather well the present and potential possibilities of the land for the production of raw materials.

Modern Turkey should be on the bookshelf of every well-informed man and woman who wishes to keep advised of the most significant recent developments in the world's affairs; it is invaluable to the libraries of our educational institutions and to those of our cities as well.

W. ELMER EKBLAW.

LYDE, LIONEL W. *The Continent of Europe.* xv and 435 pp.; maps, charts, and tables and index. MacMillan & Co., New York, 1924. $2.50. 9 x 6 inches.

This book is the most comprehensive single volume known to the writer suitable for a textbook in college classes studying the geography of Europe. It was first issued in 1913, one year before the outbreak of the World War. The second edition, prepared after the war, was issued in 1924.

The first ten chapters present a concise and scientific treatment of the continent as a whole from the standpoint of its world relations, regional relations, relief, and climate. This systematic introductory treatment of the continental whole gives a sound basis for understanding the relationships presented in the treatment of countries and groups of countries in the remaining fifteen chapters. More than a hundred maps and graphs give detailed illustration of continental features, of countries, and of smaller regions of importance. One who has used the first edition will miss the excellent colored physical double-page maps which were included in the earlier edition, but are omitted from the new edition.

Professor Lyde's technical, but accurate and scientific diction, makes the reading of the book a difficult task for the ordinary college student, but the wealth of geographic facts and the value of the geographic interpretations makes the task of mastering this book a worthy one. The description of the natural environment of the various regions of the continent and the interpretation of their relation to man's work stimulate the geographic thinking of any careful student.

One geographic topic of great importance to the peoples of Europe, but rarely considered by the people of America, is made clear, time after time, in the treatment of various countries, more especially France, Belgium, and Germany. This is the *geography of frontiers* and their strategic importance. The World War was raging when the first edition of this book came to the writer's attention in 1915. As he read the geography of the frontiers of the various countries engaged in the war, it seemed that Professor Lyde was interpreting the geography of the war in the light of the actual events of the conflict then in progress. An examination of the copyright date, 1913, showed that the interpretation had been written a year or two before the opening of the war. A careful study of all the passages of the book with reference to *frontiers* made an indelible impression. On receiving a copy of the new edition of 1924, the first desire was to test the new edition on its geography of frontiers and their significance. On page 201 in the chapter on France, the two paragraphs relating to "Lorraine Frontier" and "Military Organization" are accompanied by this note: "These two sections are retained verbatim from the 1913 edition." The foot note, page 291, in the chapter on Germany reads: "Pages 291–5, like pp. 201, 259, etc., seem to have had enough 'prognostic' value to be retained verbatim from the 1913 edition." When geographic writers, generally, interpret geographic environment and its relation to man's work, so that the interpretation stands the test of actuality as clearly as Professor Lyde's interpretation of national frontiers, then geography will be based on a strong foundation of scientific interpretation of scientific facts.

The college student and the college teacher who master this book by careful study and by persistent and intelligent use of a good atlas and the unabridged dictionary, will lay a deep and solid foundation for all future reading concerning the geography, history, economics, and civilization of Europe.

DOUGLAS C. RIDGLEY.

OUR CONTEMPORARIES

THE GEOGRAPHICAL REVIEW

Vol. XV, No. 4. October, 1925

The Danish Ethnographic and Geographic Expedition to Arctic America. 42 pages. Knud Rasmussen.

A valuable study by the most competent and trained investigator of Eskimo history, traditions and culture.

Java: The Economic Geography of a Tropical Island. 21 pages. S. van Valkenberg.

One of the most significant papers in regional economic geography that has appeared in recent publications. The relationships between the physical environment, the agriculture, and the density of population are clearly brought out.

Shangtu, The Summer Capital of Kublai Khan. 21 pages. Lawrence Impey.

An interesting article from an archaeological viewpoint.

The Norsemen in Greenland. 12 pages. William Hovgaard.

Another interesting archaeological paper that throws new light on an old subject.

The Topography of the Amazon Valley. 21 pages. C. F. Marbut and C. B. Manufold.

A thorough presentation of the physiographic features of the great Amazon valley, prerequisite to any well-founded economic discussion, or sound geographic study.

The Question of Peary Channel. 7 pages. Lauge Koch.

A logical, analytical, convincing statement of all the facts in the case, that clears up the controversy in a way that reflects credit upon the author, and establishes for all time Admiral Peary's veracity and good faith in his original survey and map.

The First Sighting of West Antarctica. 4 pages. Edwin Swift Balch.

Geographical Record.

Geographical Reviews.

THE JOURNAL OF GEOGRAPHY

Vol. XXIV, No. 6. September, 1925

Objectives of Geography Instruction. 10 pages. W. R. McConnell.

The Pitch Lake, Trinidad. 9 pages. Preston E. James.

A brief description of a unique deposit and the industry dependent upon it.

A Typical Farm in the Corn Belt: A Project. 7 pages. A. E. Shirling.

Economic geography as the line of attack with agriculture as the basis for an elementary project study in the relationship of physical and economic factors in the social development.

The Development of a World Port: Hampton Roads. 4 pages. Loulie C. Kelley.

Another type of project along the lines of Economic Geography with trade instead of agriculture as the basis.

A Forestry Project. 3 pages. Kathleen Gray.

And a third similar project based on forestry.

The April Picture Contest.

Geographical Publications.

THE NATIONAL GEOGRAPHIC MAGAZINE

Vol. XLVIII, No. 2. August, 1925

Waimangu and the Hot-spring Country of New Zealand. 22 pages. Joseph C. Grew.
A thrilling description of a fascinating land and its wonders.

Tripolitania, Where Rome Resumes Sway. 24 pages. Gordon Casserly.
A descriptive account of Italy's old African colony, restored to her dominion in 1911.

Under Italian Libya's Burning Sun. 8 pages. Luigi Pellerano.

Toilers of the Sky. 28 pages. McFall Kerbey.
The work of clouds stated in bright text and illuminating pictures.

From England to India by Automobile. 34 pages. Major F. A. C. Forbes.
A fluent summary of rapidly changing scenes and conditions along the way, pertinently illustrated.

The MacMillan Arctic Expedition Sails. 3 pages.
The plan, the personnel, and a promise.

Vol. XLVIII, No. 3. September, 1925

Everyday Life in Pueblo Bonito. 36 pages. Neil M. Judd.
The work af the exploring party, and the life of the Bonitians, backyard farmers, well told and brilliantly illustrated.

Exploring in the Canyon of Death. 38 pages. Earl H. Morris.
A textual and pictorial account of interest and value.

New Discoveries in Carlsbad Cavern. 30 pages. Willis T. Lee.
The epic of a true scientist's reconnaissance work in a new field full of promise.

Experiences of a Lone Geographer. 18 pages. Joseph F. Rock.
One more valuable contribution to our knowledge of Cathay.

Scientific Aspects of the MacMillan Arctic Expedition. 6 pages.

THE JOURNAL OF LAND AND PUBLIC UTILITY ECONOMICS

Vol. 1, No. 3. July, 1925

Undepreciated Investment as a Utility Rate Base. 13 pages. George C. Matthew.

The Real Estate Code of Ethics. 6 pages. Herbert V. Nelson.

The Uniform Accounting Systems advocated by Utilities Commissioners. 16 pages. Hiram T. Scovill.

A Challenge—To the Public? Or to the Real Estate Business? 8 pages. John D. Black.

Practical Policies of Land Colonization. 5 pages. B. F. Faast.

Public Utility Financing, 1919–1925. 17 pages. Herbert B. Doran.

The Public Leasehold System in The United States. 14 pages. Mary L. Shine.

Relationships of Landlords to Farm Tenants. 7 pages. F. A. Buechel.

The Public Control of House Rents. 19 pages. Marcus Whitman.

Book Reviews.

Summaries of Research.

Comments on Legislation and Court Decisions.

NEWS ITEMS

COLUMBIA UNIVERSITY

Department of Economic Geography

Prof. J. Russell Smith sailed from San Francisco on July 15 for the Orient, accompanied by Mrs. Smith and two of their sons. Professor Smith will spend the next twelve months chiefly in Japan, China, India, and the arid regions of southwestern Asia. During Professor Smith's absence, the Department of Economic Geography will be in charge of Prof. John E. Orchard.

Mr. George T. Renner, lecturer in economic geography, has completed his residence work at Columbia University for the degree of Doctor of Philosophy and has passed the general examinations. He is now at work upon his thesis. During the summer, Mr. Renner was a member of the field party of the University of Chicago in the Upper Peninsula of Michigan and the Door Peninsula of Wisconsin. Mr. Renner will assist this year in the general course in economic geography at Columbia and will also give courses on the economic geography of Latin America and the economic geography of Africa and Australia.

Mr. Louis A. Wolfanger, lecturer in economic geography, attended the University of Chicago during the first term of the summer quarter. During August and September he did field work in Nuckolls County, Nebraska, for the United States Soil Survey. Mr. Wolfanger will complete the residence requirements for the degree of Doctor of Philosophy this fall. In addition to assisting with the introductory course in economic geography, he will give a course on the economic geography of North America.

Mr. Howard H. Martin, a graduate student last year in the Department of Economic Geography, has been appointed assistant professor of geography at the University of Cincinnati. Professor Martin will be associated with Professor Fenneman in the economic survey of the city of Cincinnati, that is being carried on by the Department of Geology and Geography. Professor Martin spent most of the summer assisting Professor Smith in the revision of his *Industrial and Commercial Geography*.

The secretary's office has prepared a special announcement of courses in geography and related subjects. The announcement contains, in addition to the courses in physiography, economic geography, and the teaching of geography, a list of courses in economics, political science, history, sociology, botany, and zoölogy, of interest to the specialist in human, plant or animal geography.

Prof. John E. Orchard gave the introductory course in economic geography in the summer session. In the winter and spring sessions, in addition to having charge of the general course, he will give courses in the economic geography of Asia and the economic geography of Europe, and will conduct the geographic seminar. Professor Orchard is at present carrying on his investigations in certain economic problems relating to the coal industry. In the February number of the *Quarterly Journal of Economics* he published a "Proposal for the Regulation of the Coal Industry," and now has in preparation an article on the ownership of coal lands.

Mr. W. L. G. Joerg, Associate Editor of the *Geographica lReview*, and Editor of the *Research Series of the American Geographical Society*, will give a course during the spring session on the "Geographic Factor in Economic and Social Development." Mr. Joerg plans to consider problems having special reference to city geography, the geography of national groups, regional classification, climatology, and the history of classification.

Prof. C. P. Berkey, geologist to the Third Asiatic Expedition, is in Mongolia, where he will remain until late in the fall, carrying on explorations begun three years ago. He is accompanied by Prof. Frederick K. Morris who is giving special attention to the physiography of the region.

Prof. Douglas Johnson spent a week in Texas, during the summer, studying the effects of a recent local subsidence of the coast on certain oil properties, and visiting the dune and basin region bordering the Laguna Madre.

John Wiley and Sons recently issued Professor Johnson's new book on "The New England-Acadian Shoreline," the manuscript for which was awarded the A. Cressy Morrison prize of the New York Academy of Sciences. Recently the Société de Géographie Commerciale de Paris awarded Professor Johnson its Edouard Gaudy Medal.

UNIVERSITY OF CHICAGO

Degrees Granted at the Spring Convocation

Doctor's Degree:

Earl C. Case, thesis, "The Adjustment of Industry to Natural Environment in the Valley of Tennessee."

John B. Appleton, thesis, "The Iron and Steel Industry of the Calumet District—A Study in Economic Geography."

Clifford M. Zierer, thesis, "The Industrial Geography of Scranton."

Master's Degree:

Henry F. Becker, thesis, "The Climatic Regions of South Africa."

Gordon P. Merriam, thesis, "The Regional Geography of Asia Minor."

Guy V. Richey, thesis, "A Study of the North American Winter Hyperbar."

Mina Southard, thesis, "A Geographic Interpretation of Butte, Montana as A Copper Mining and Smelter Center."

Dr. Case continues as assistant professor of geography in the University of Cincinnati.

Dr. Appleton becomes assistant professor of geography in the University of Illinois, and Dr. Zierer becomes assistant professor of geography in the Southern Branch of the University of California.

Fellowships granted for 1925–26: Will Trout Chambers (S.M. Chicago, 1924), Eric Pearson Jackson (A.M. Clark, 1923), Father Lambert Nicolas Polspoel, Licencie en Sciences Commerciales, Universite de Louvain, 1923).

Dr. Senstius is in the Dutch East Indies and the Philippine Islands studying the relations between the formation and characteristics of tropical soils and tropical climates and vegetation particularly and incidentally the agriculture of Malaysia and the Philippine Islands. If this work does not occupy all his time he will make a reconnaissance of the physical regions of tropical Australia as a factor in the problem of permanent white settlement in that region.

Dr. Whittlesey, accompanied by Harold S. Kemp, a graduate student, has made an intensive study of Martinique and a more incidental study of all the lesser Antilles which they visited last winter. Mr. Kemp will base his dissertation upon the field work of this trip.

The department will coöperate with the Chicago Regional Planning Association in certain geographic investigations to shape the policies and plans for future development of the Chicago area.

Chicago geographers are authors of the following published works: "An Introduction to Economic Geography," by Dr. Jones and Dr. Whittlesey, recently published by the University of Chicago Press. The scope of the book is indicated by its subtitle, "Natural Environment as Related to Economic Life." "The Formation of Soils in Equatorial Regions," by Dr. Sentius, in the Fifth Annual Report of the American Soil Survey Association (1925); "Across Seven Seas to Seven Continents," by Alison E. Aitchison and Marguerite Uttley, is a geographical reader for the third or fourth grade just published by the Bobbs-Merrill Company; "Tropical Cyclones and the Dispersal of Life from Island to Island in the Pacific," "Effects of Tropical Cyclones upon Weather of Mid-Latitudes," by Stephen S. Visher, the latter published in the *Geographical Review*, and the former in the *American Naturalist;* "Geography for the High School," by H. M. Leppard, in the *Journal of Geography;* "Elementary Geography: Objectives and Curriculum," by Miss Parker and Dr. Barrows in the *Elementary School Journal;* "Unit Studies in Geography," by Rose B. Clark, published by the World Book Company; "Geography of the Mountains of Eastern Kentucky," by D. H. Davis, published by the *Kentucky Geological Survey;* "Studies in the Geography of Brazil: East Central Brazil," by William H. Haas, published in the *Journal of Geography;* "A Geographic Analysis of the Apple Industry of the Annapolis-Cornwallis Valley," by Dr. C. C. Colby, published in the July number of ECONOMIC GEOGRAPHY; "The Grain Trade of Montreal," by Clarence F. Jones, published in the March issue of ECONOMIC GEOGRAPHY; "Cleveland, a City of Contacts," by Dr. Helen M. Strong, published in the July number of ECONOMIC GEOGRAPHY, and several new maps by Dr. Goode, part of his series of base maps.

Clyde J. Bollinger has been granted leave of absence from his position as assistant professor of geography in the University of Oklahoma to continue his work here.

Margaret Warthin, a graduate student of last year has joined the staff of the American Geographical Society.

Henry F. Becker has been appointed instructor in geography in Marshall College, Huntington, W. Va.

Sidman P. Poole, instructor in geography in Syracuse University spent the summer traveling in Scotland and on the continent and attending the Summer School at Oxford University.

Thomas R. Taylor, assistant director of the U. S. Bureau of Foreign and Domestic Commerce has been elected to membership in the Association of American Geographers, and V. C. Finch, associate professor of geography at the University of Wisconsin has been made a member of the National Research Council, Division of Geology and Geography.

Genevieve Lamson and Olive J. Thomas have been promoted to assistant professorships; the latter in Milwaukee Downer College, the former in Vassar College; while Edith Kraft has been made head of the Science Department in the High School of Huntington Park, a suburb of Los

Angeles, and Louise Boswell has been made instructor in geography in the Western State Normal School at Kalamazoo, Mich., the fourth member of the faculty there from the Department of Geography at Chicago University, and Miss Nelle G. Hudson has been made head of the Department of Geography and Natural Science in the Edinboro Normal School, Pennsylvania.

Edwin J. Foscue has been promoted to an assistant professorship in geography in the Southern Methodist University, Dallas, Texas.

CORNELL UNIVERSITY

Mr. A. W. Abrams, director of the Division of Visual Instruction, New York State Department of Education, is making a collection of 8 x 10 negatives illustrating the geography of the state, physical, regional and economic. Over 1600 subjects have already been secured, most of them new items taken either by himself or his assistants. These negatives will be used for the making of lantern slides and prints for free distribution as loan collections to New York State schools and are to be basic material for instruction in the geography of the state as directed in a new syllabus for geography in New York state schools now in preparation.

Other states, notably Pennsylvania, Ohio and Kansas, are organizing similar bureaus and are also collecting such negatives. It has been suggested that exchange of copy negatives between these various state bureaus will lead eventually to rich collections of material illustrating the geographic features of all of the United States being made available to teachers everywhere.

UNIVERSITY OF NEBRASKA

Miss Ruth McDill, A.M. in geography, University of Nebraska, June, 1925, has been elected instructor in geography in the University of Oklahoma, Norman, Oklahoma, during the coming year.

Mr. Ansel B. Clayburn, professor of geography at the State Teachers' College at Peru, Neb., received his Master's Degree in geography at the University of Nebraska at the close of the summer session. The title of his thesis is "The Geographic Influences in the Development of Omaha."

The next building to be constructed at the University of Nebraska will be Morrill Hall, designed to house geography, geology, fine arts, and the museum. The detailed plans for the building are now being made; it will cost $350,000. It is named in honor of one of the former regents, a liberal donor of funds for geological investigations.

UNIVERSITY OF NORTH CAROLINA

Collier Cobb has been engaged during the year in the physical analysis and microscopic examination of wheat soils from all parts of the earth, a part of the results obtained having been given to the North Carolina Academy of Science in May under the title of "Loessal Soils and the World's Food Supply." He has found that the great stretches of grain-producing soils, whatever their origin, are composed of finely comminuted rock material in which the component mineral particles show but little chemical change. This is equally true of glacial, loessal, and desert soils.

Professor Cobb has also studied an oil shale (a light gray clay-like substance—soft pelite) found by him in Ontario, Canada. This substance burns like bitumen, and is made up of the leaves of *salix*, *vaccinium*, and other species which still grow in the same general region and in northern Asia, and of the spores of a number of flowerless plants with essentially the same distribution, and extending well down into the main island of Japan (Honshiu).

UNIVERSITY OF WISCONSIN

DEPARTMENT OF GEOGRAPHY

Members of the geography staff were widely scattered during the summer.

Prof. V. C. Finch taught at Clark University.

Prof. A. K. Lobeck conducted his annual field party to the Rocky Mountains in June and early July, and later taught during the summer session at Columbia University, after which he took his usual field party from Columbia up the Hudson valley to the Adirondacks, eastward through the Green and White Mountains to the New England coast and back to New York.

Dr. Glenn T. Trewartha taught at Penn State College in Pennsylvania, and later joined Dr. Lobeck's field party in the east.

Dr. R. H. Brown taught at Peabody College, Nashville, Tenn. Mr. John Frey was secretary to Prof. C. K. Leith at the Williamstown Economic Conferences during July and August.

There were 360 students enrolled in geography courses during the summer session.

Three new assistants have been added to the geography staff for the coming year; R. H. Licking, Arthur Tillman, and Leland S. Paine. It is expected that R. H. Whitbeck's book on the "Economic Geography of South America" will

be issued in January, 1926 (The McGraw-Hill Book Co.).

CLARK UNIVERSITY

The following students are enrolled in the Department of Geography for the coming year:

Ruth E. Baugh, A.B., Univ. of California, 1921.

Meredith F. Burill, A.B., Bates, 1925.

Earle R. Casto, B.S., W. Va. Wesleyan, 1911; M.S., W. Va. Wesleyan, 1913; A.M., G. Peabody Col., 1918; Candidate Ph.D., Clark, 1926.

C. E. Cooper, A.B., Michigan, 1916; M.S., Michigan, 1917; Candidate Ph.D., Clark, 1926.

W. Elmer Ekblaw, A.B., Illinois, 1910; M.A., Illinois, 1912; Candidate Ph.D., Clark, 1926.

Mrs. W. Elmer Ekblaw, A.B., Illinois, 1910; M.A., Illinois, 1914.

Lillian Girard, A.B., Michigan, 1924; M.A., Clark, 1925.

Olof Jonasson, Univ. of Commerce, Stockholm, 1916; A.M., Univ. of Stockholm, 1921. Admitted as a licentiate for the degree of Doctor of Philosophy, 1922, the degree to be granted upon the acceptance and publication of his dissertation.

Donald Keller, B.S. in Geography, Indiana State Normal.

Ella B. Knight, A.B., Univ. of Omaha, 1921; A.M., Clark, 1924.

Harley P. Milstead, B.A., Illinois State Normal.

G. W. Morris, A.B., Cincinnati, 1922; A.M., Harvard, 1925.

Dorothy V. Noble, A.B., Illinois, 1924.

Gragg Richards, B.S., Harvard, 1902; M.S., 1903; M.A., 1925.

H. H. Russell, B.Ed., Illinois State Normal, 1920; M.A., Clark, 1924; Candidate Ph.D.

Esther G. Treahy, B.A., Ohio State Univ., 1924; M.A., Ohio State Univ., 1925.

E. VanCleef, B.S., Chicago, 1908; Student, Univ. of Leipzig, 1913–1914; Candidate Ph.D., Clark, 1926.

Margaret C. Walker, A.B., Mills College, 1922; A.M., Mills College, 1924.

Miss Ellen C. Semple, who has been teaching at the University of Southern California during the spring term, has returned to Clark University.

Langdon White, Ph.D., 1925, is instructor in geography at the University of Pittsburgh, Pittsburgh, Pa.

Rollin S. Atwood is instructor in geography in a Trenton, N. J., high school.

OHIO STATE UNIVERSITY

DEPARTMENT OF GEOGRAPHY

The registration at the beginning of the autumn quarter, with two courses withdrawn for the year 1925–26, totals 670.

Mr. R. R. Sharrock, M.A. in geography and foreign trade at the end of the summer quarter, is now teaching in the College of the City of Detroit.

Mr. Fred Donnally, a graduate of the university and with three years of valuable experience with the U. S. Chamber of Commerce, has been added to the staff.

The Bureau of Business of Research of the College of Commerce, in which college the Department of Geography is administered, is making a special study of the effects of the weather upon seasonal building construction in Ohio.

Roderick Peattie, who for the summer has been teaching at Northwestern University, has returned to Ohio State and has been advanced to the position of professor of geography.

UNIVERSITY OF MICHIGAN

DEPARTMENT OF GEOGRAPHY

Prof. K. C. McMurry spent the latter part of the summer in northern Michigan where he assisted the Michigan Land Economic Survey in its work on Menominee County.

Mr. R. B. Hall returned about the middle of October from Haiti. He has been making a field study of the western part of the island as a guest of the Navy Department.

Mr. Stanley D. Dodge has been added to the department as an instructor. He has nearly completed his work for a Doctor's degree at the University of Chicago.

Prof. W. M. Davis spent two days in Ann Arbor as the guest of the Departments of Geology and Geography. He discussed the formation of block mountains and the origin of coral reefs in informal talks before the members of the departments and advanced students. He also gave a public address on "The Lessons of the Grand Canyon."

ANNOUNCEMENT

Agricultural Regions of Europe, by Olof Jonasson, the carefully prepared and well illustrated article in this issue of ECONOMIC GEOGRAPHY begins the series of six articles which, when completed, will constitute a complete and comprehensive treatment of *Agricultural Regions of the World.*

The second in the series, *Agricultural Regions of North America*, by O. E. Baker, based on the most accurate and authentic data available at the time of going to press, will follow in the January issue; the third in the series, *Agricultural Regions of South America*, by Clarence F. Jones, who has recently returned from an extended journey through South America, will appear next April.

The series will continue in succeeding issues with separate articles on *Agricultural Regions of Asia, of Africa, and of Australia.*

One series of maps of adequate dimension will accompany the articles to indicate these *agricultural regions* and another series to indicate the *regions of land utilization* as fully as accurate data are available. Smaller maps, charts and pictures will further illustrate the articles.

To obtain the complete series of these extremely valuable articles which present for the first time on such a comprehensive and accurate basis the significant divisions of the world's most important industry, it will be necessary to subscribe at once for ECONOMIC GEOGRAPHY, beginning with the October issue.

In addition to this series of articles on agriculture, an industrial series will be initiated soon; every issue will also contain four or five other articles dealing with urban and regional geography, with problems of land utilization, with programs of development of resources, with commerce, with transportation, with health, and with the hundred and one other subjects that are of present geographic interest, all by the most competent and best informed authorities in their respective fields. ECONOMIC GEOGRAPHY is indispensable to the intelligent citizen.

The subscription price for the United States and possessions is $4.00 the year or $7.50 for two years. To all foreign countries, $4.50 the year or $8.50 for two years. Address ECONOMIC GEOGRAPHY, Clark University, Worcester, Mass., U. S. A.

ECONOMIC GEOGRAPHY

A QUARTERLY journal of Economic Geography published by Clark University for the benefit of geographers, economists, teachers, professional and business men, and all who are interested in the intelligent utilization of the world's resources.

Subscription, $4.00 the year in the United States and its Territories; $4.50 the year beyond the borders of the United States.

Only a limited number of the first issue of ECONOMIC GEOGRAPHY are available. This issue includes the following articles:

The Relation of Geography to the Timber Supply, W. B. Greeley, U. S. Forestry Service.
Geography and Wheat Production, O. E. Baker, Economist, U. S. Bureau of Agricultural Economics.
The Grain Trade of Montreal, Clarence F. Jones, Professor of Economic Geography, Clark University.
The Coal Resources of Canada, M. J. Patton, Economist, Natural Resources Intelligence Service, Dominion of Canada.
A Land Policy for the Public Domain, George R. Stewart, Agronomist, Utah Agricultural Experiment Station.
Map Studies of Population and Cultivated Lands in Scandinavia, Olof Jonasson, Economic Geographer, Geographic Institute of Stockholm, Sweden.

The second issue, of which numbers can still be obtained, contains the following articles:

A World of Power, George Otis Smith, Director, U. S. Geological Survey.
The Distribution of Domestic Animals, Ellsworth Huntington, Climatologist, Yale University.
The Apple Industry of the Annapolis-Cornwallis Valley, Charles C. Colby, Economic Geographer, University of Chicago.
Cleveland: A City of Contacts, Helen M. Strong, Geographic Expert, Bureau of Foreign and Domestic Commerce.
The Insular Integrity of Industry in the Salt Lake Oasis, Langdon White, Economic Geographer, Clark University.
The Geographic Effects of the Proposed Great Lakes-St. Lawrence Waterway, W. S. Bayley, Geologist, University of Illinois.
Geographic Factors in the Development of Transportation in South America, Preston E. James, Assistant Professor, University of Michigan.

Copies of these numbers will be sent to any American address for $1.25 each; to any foreign address for $1.50.

Separates may be obtained as follows:

The Relation of Geography to the Timber Supply, W. B. Greeley, 14 pp. Price, 50 cents.
Geography and Wheat Production, O. E. Baker, 37 pp. Price, 75 cents.
Both Booklets for $1.00

A limited number of separates of other articles in the March and July issues are still available at the rate of 2½ cents per page per copy.

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OUR CONTRIBUTORS

Mr. Jonasson has been a member of the instructional staffs of the University of Commerce in Stockholm, and the University of Stockholm, in both of which he has studied. He is now on leave of absence from the University of Stockholm to continue his studies on the distribution of the small grains, at the United States Department of Agriculture and Clark University. During the past summer he has toured Canada and western United States studying land utilization in the various agricultural regions, and particularly the distribution of the small grains, the field of economic geography in which he has specialized and in which he is most interested. His knowledge of agriculture is accurate and first hand.

Mr. Barker is reader in geography at Manchester University, England, formerly professor at University College, Southampton, and lecturer in London University. From 1909 to 1912, as principal of the Government College, Accra, Gold Coast, he began these studies of tropical African geography with which his name is so closely associated.

Dr. Colby, professor of geography in the University of Chicago, is secretary of the Association of American Geographers, and a member of the Division of Geology and Geography of the National Research Council. He is the author of a "Source Book for the Economic Geography of North America." Recently his monograph on "The California Raisin Industry — A Study in Geographic Interpretation" was published in the Annals of the Association of American Geographers. During the war he was special expert in the commodity section in the Division of Planning and Statistics of the United States Shipping Board.

Miss Foster, assistant-professor of geography in the department of geology at Mount Holyoke College, has contributed "The Principal Geographic Divisions of Mexico" to the Colby "Source Book for the Economic Geography of North America," and "A Geographical Interpretation of the Cotton-Manufacturing Industry of Orizaba, Mexico" to the Bulletin of the Geographical Society of Philadelphia, April, 1924. During several years spent in educational work in Orizaba, Miss Foster met personally many officials and business men who gave her much valuable first-hand information which combined with her own careful studies and observations has furnished her the material for her series of articles on Mexico.

Miss Anderson has made a special study of the economic and industrial aspects of the beet sugar industry, with particular attention to Nebraska, where she is instructor in geography at the State University. She is the author of "The Sugar Beet Production in Nebraska," which appeared in the *Journal of Geography* in April, 1920, and "The Significance of Some Population Changes in Nebraska Since 1880" which was published in the October issue of the *Journal of Geography* in 1922. She has also contributed articles on the "Beet Sugar Industry" for publication in Bulletins 14 and 16, "Nebraska Resources and Industries," published by the Conservation and Survey Division of the University of Nebraska.

Dr. Voskuil, now instructor in industry at the Wharton School of Finance and Commerce, University of Pennsylvania, was formerly connected with the Institute for Research in Land Economics and Public Utilities, Madison, Wisconsin. He is the author of "Water Power Situation in the United States," published in the *Journal of Land and Public Utility Economics*, and "The Depletion of Soil Phosphorus" appearing in the July, 1923, issue of the *American Fertilizer*.

Mr. Gregg has recently returned from a trip through the West Indies and to the Guianas. He is chief of the Transportation Division, Department of Commerce. Prior to his connection with the department he was adviser on shipping questions with the American International Corporation. During the war he was a captain with the Shipping Section of the General Staff. He is the author of many articles on shipping which have appeared in scientific and popular magazines.

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"Nature has been so silent in her persistent influence over man, that the geographic factor in the equation of human development has been overlooked."

ELLEN CHURCHILL SEMPLE.